

FIG. 1A

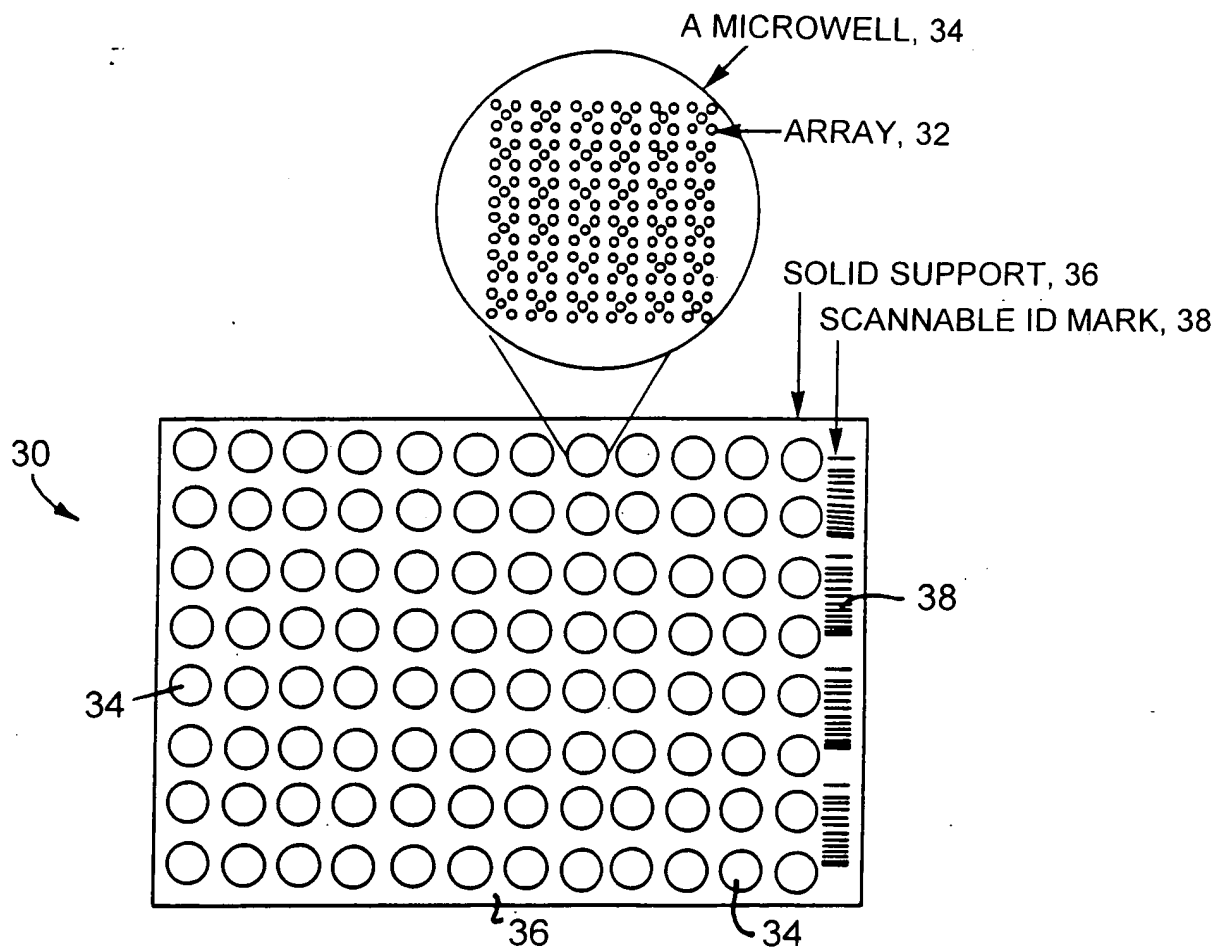
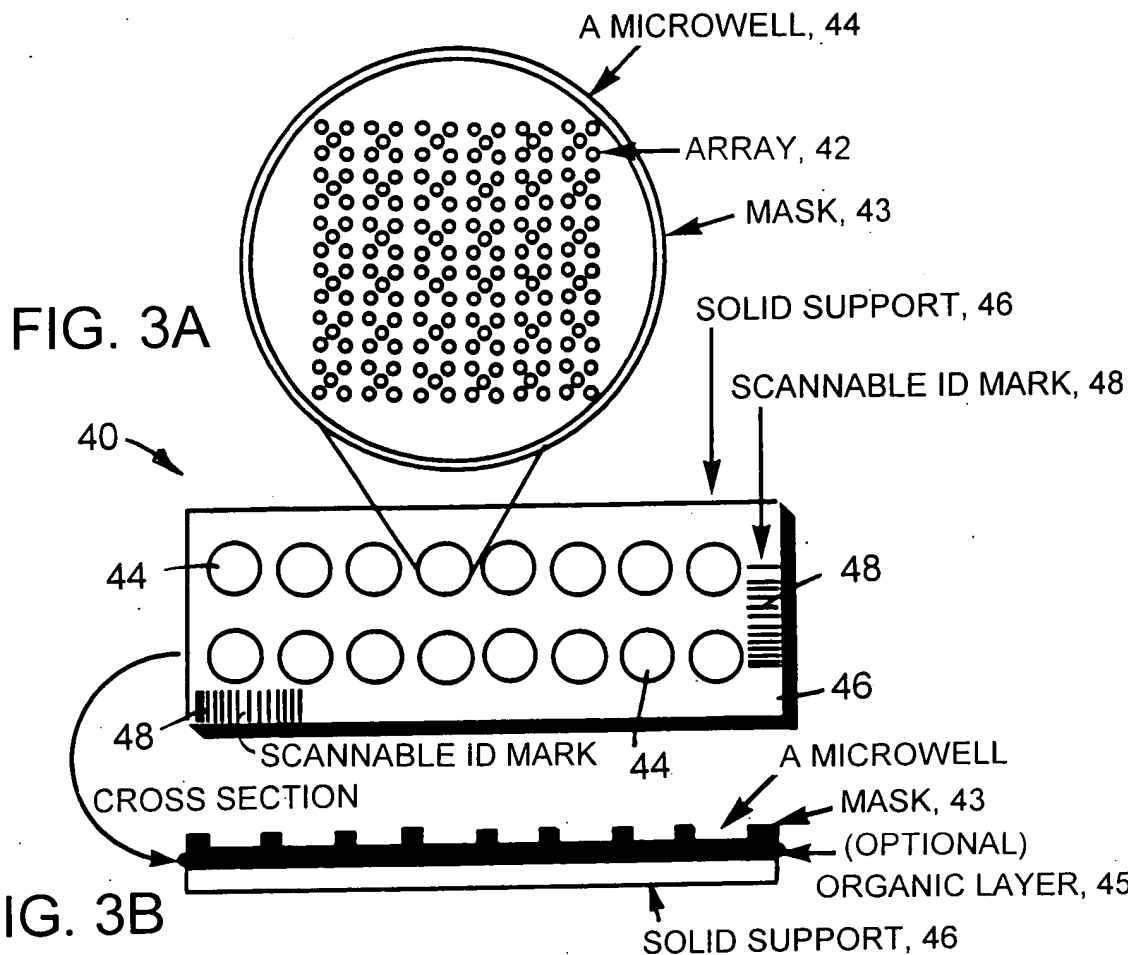
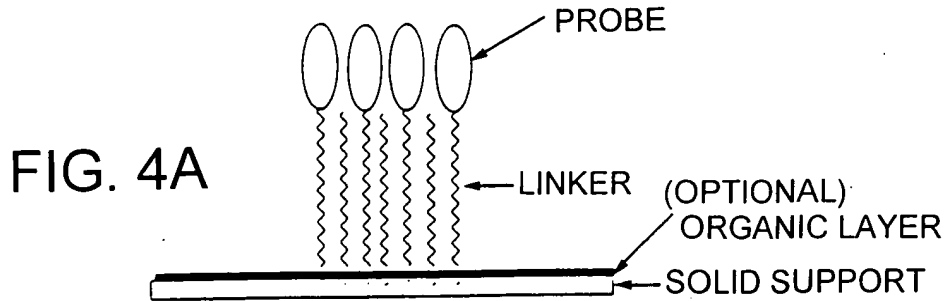


FIG. 1B

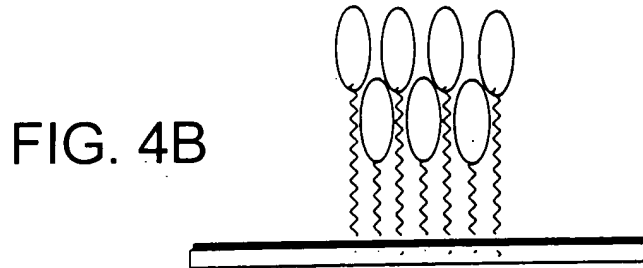




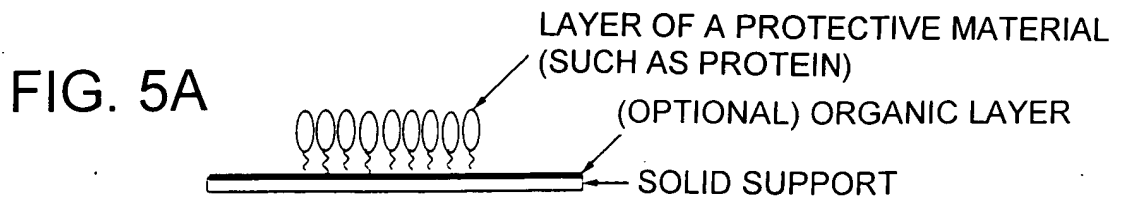
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ATTACHING PROBES TO SOLID-SUPPORT WITH LINKERS OF THE SAME LENGTH RESULTS IN LOWER DENSITY OF PROBE ATTACHMENT



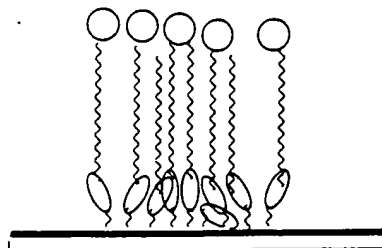
ATTACHING PROBES TO SOLID-SUPPORT WITH LINKERS OF DIFFERENT LENGTHS RESULTS IN MUCH HIGHER DENSITY OF PROBE ATTACHMENT



A LAYER OF PROTECTIVE MATERIAL IS LAID WITH SMALL LINKERS

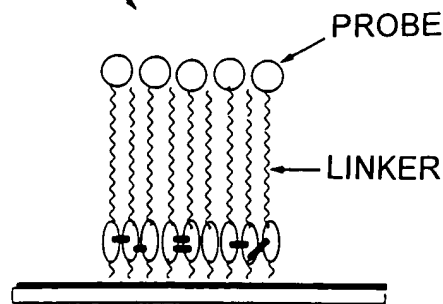
NO CROSS-LINKING

CROSS-LINKING



FINAL PROBE LINKING MAY RESULT IN A DIS-ORDERING ARRAY

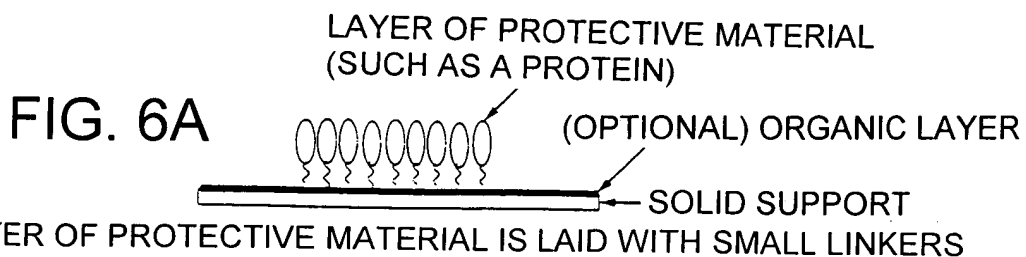
FIG. 5B



FINAL PROBE LINKING MAY RESULT IN AN ORDERED ARRAY

FIG. 5C

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NO CROSS-LINKING

CROSS-LINKING

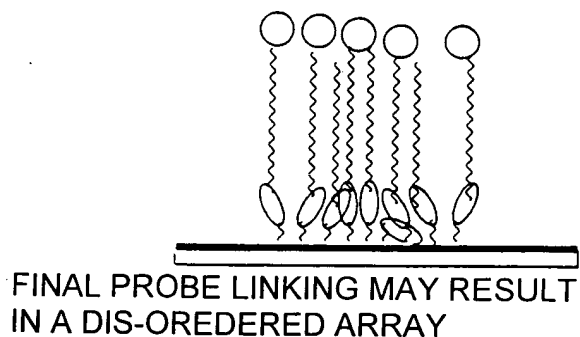


FIG. 6B

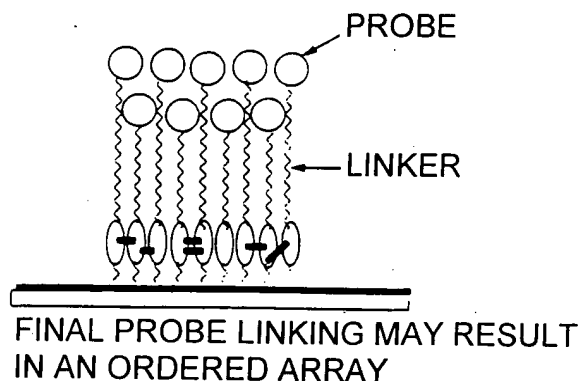
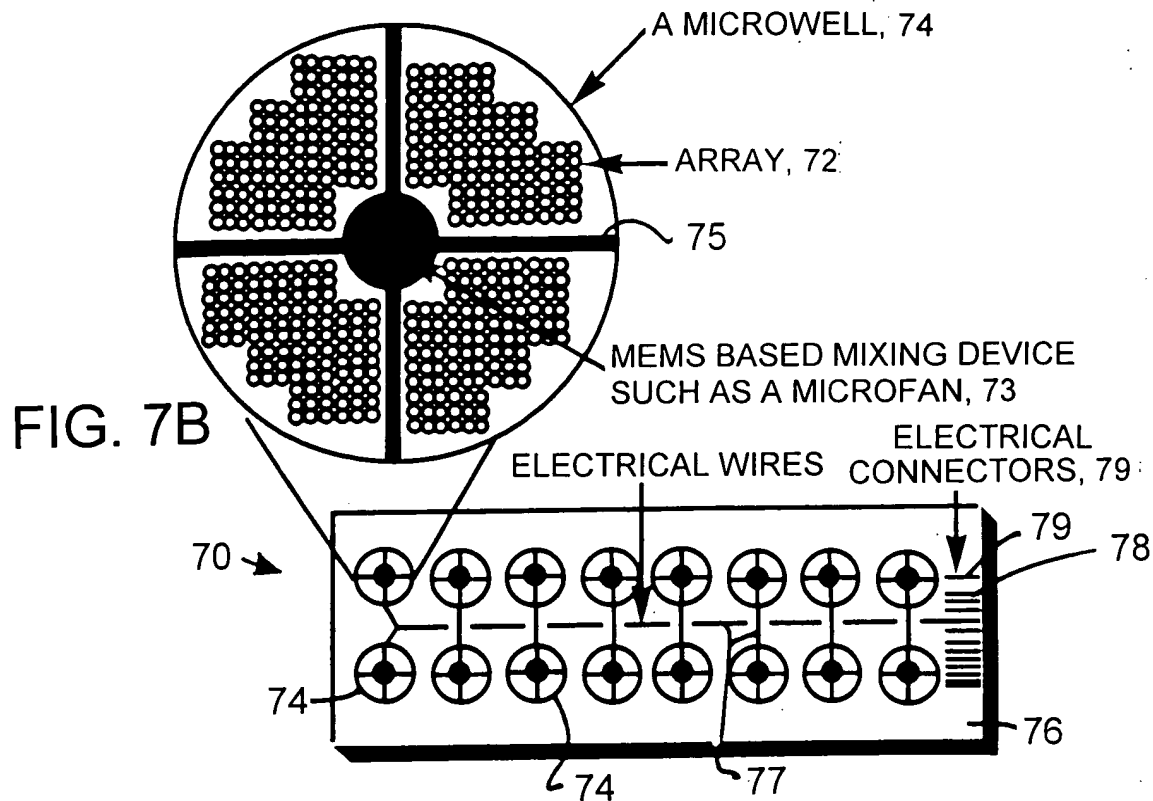


FIG. 6C



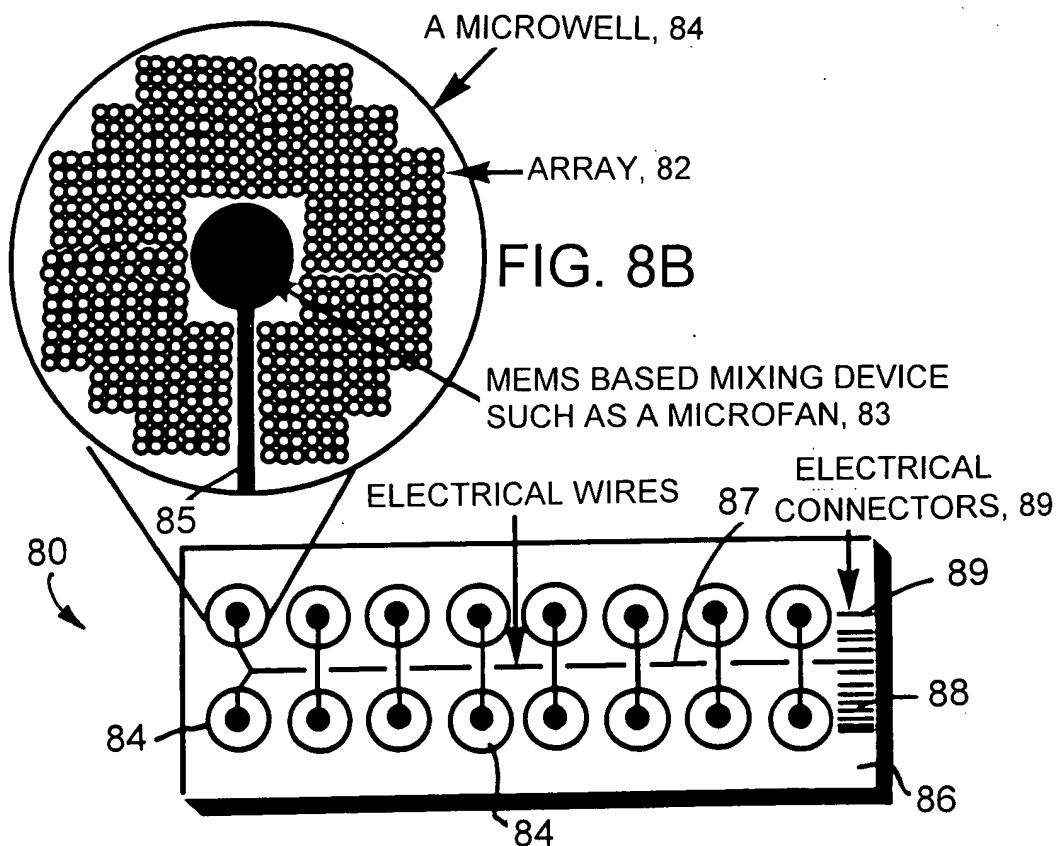
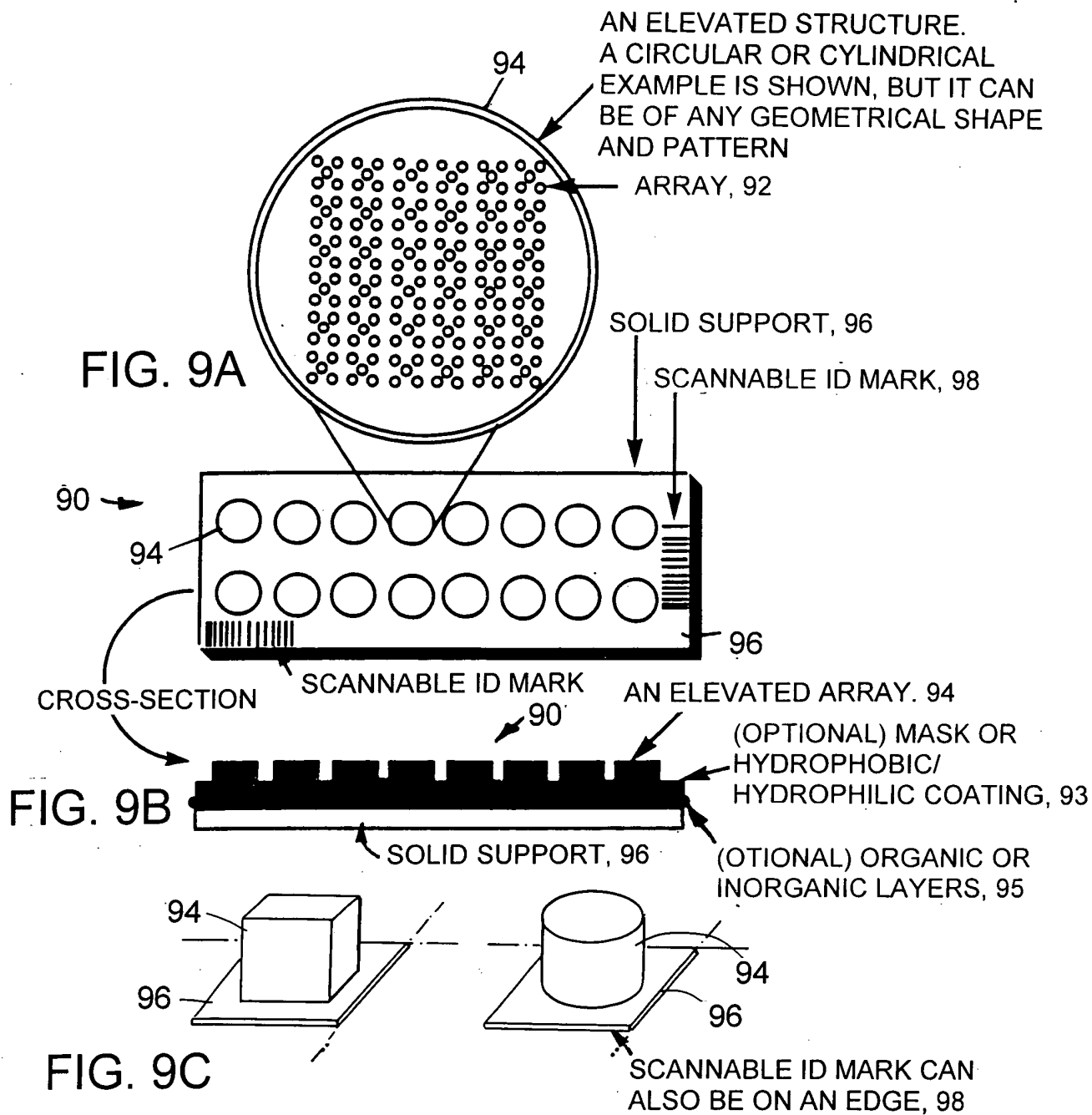


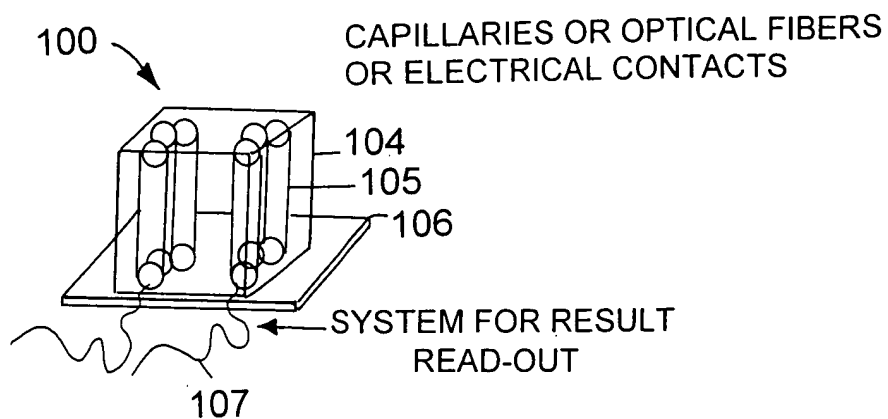
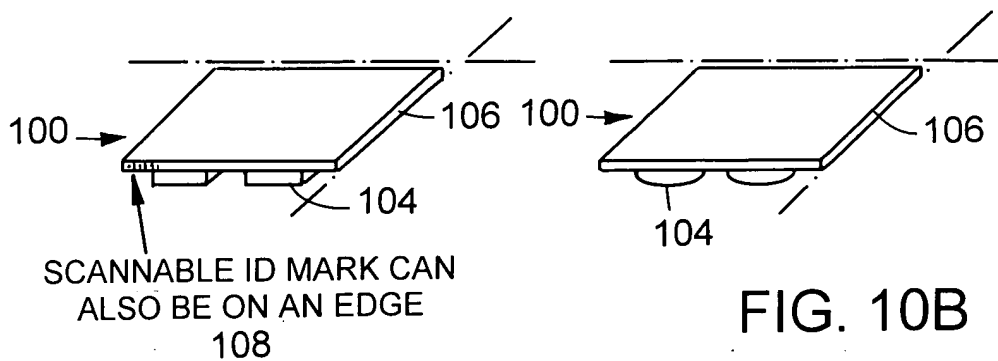
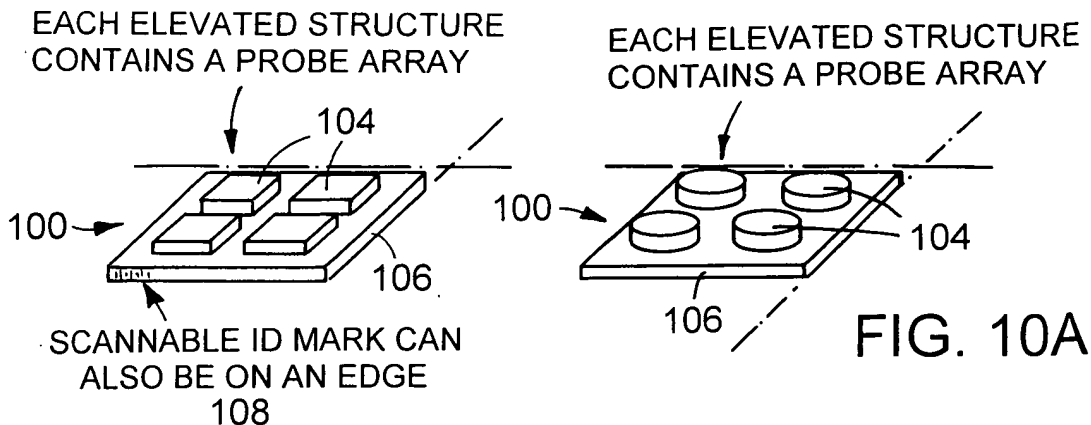
FIG. 8A

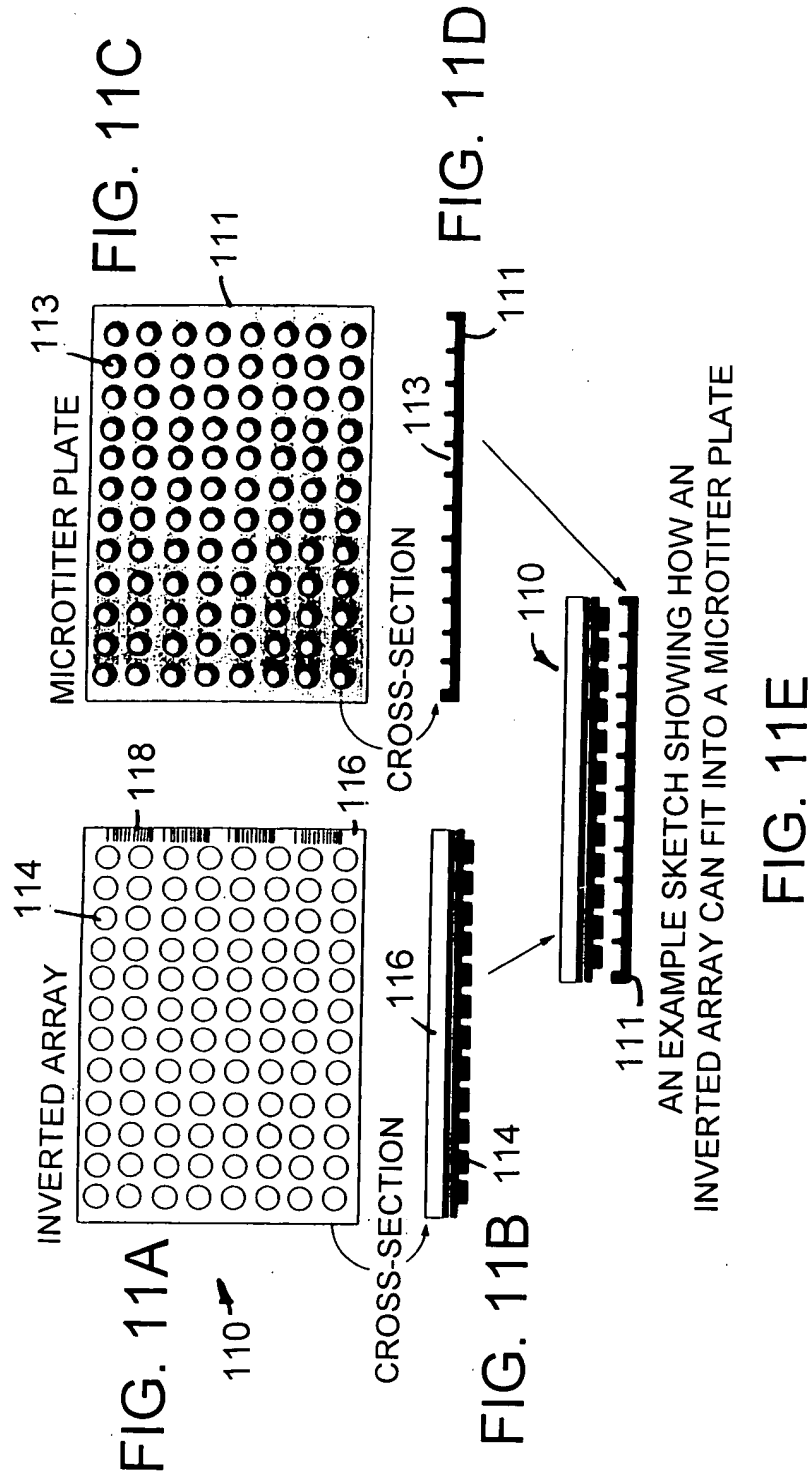
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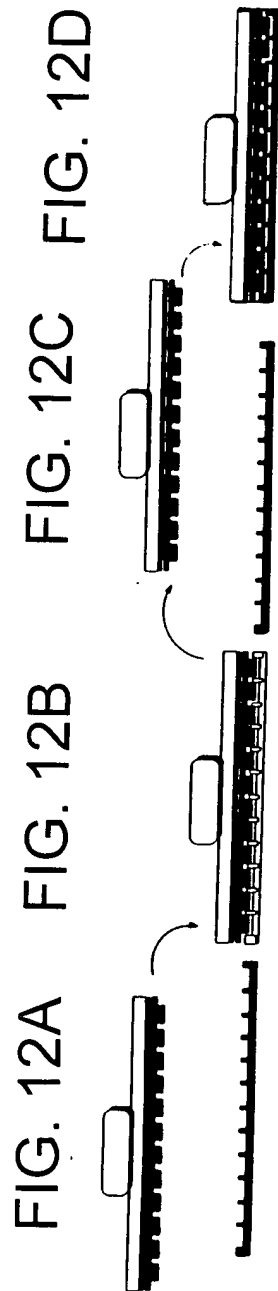
EXAMPLES OF ELEVATED STRUCTURES ON SOLID SUPPORT.
 THE STRUCTURES CAN BE CYLINDRICAL OR CUBOID OR ANY
 OTHER GEOMETRICAL SHAPE

TWO VIEWS OF TWO TYPES OF "INVERTED ARRAYS"





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THE "INVERTED ARRAY" CAN BE MOVED FROM ONE REACTION VESSEL TO ANOTHER. IT CAN BE MOVED EITHER USING A BUILT-IN HANDLE OR USING A VACUUM SUCTION DEVICE OR ANY OTHER MECHANISM. THE PROCESS CAN BE DONE MANUALLY OR ROBOTICALLY AND THE ASSAY PROCEDURE CAN BE EASILY AUTOMATED. THIS SCHEMATIC SHOWS AN EXAMPLE OF ONE SUCH PROCESS.

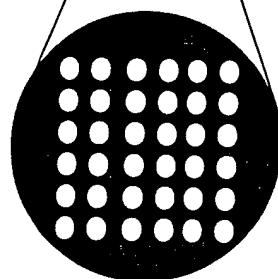
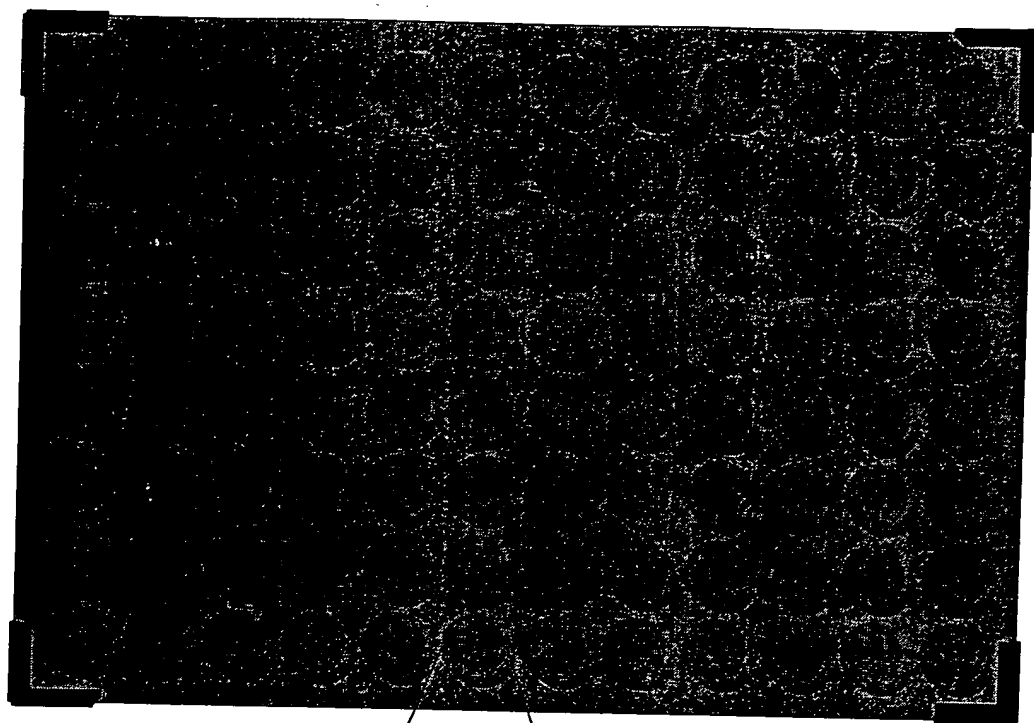


FIG. 13A

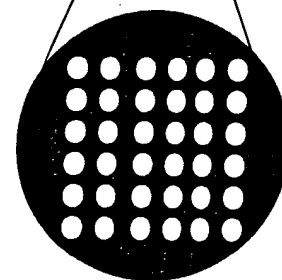


FIG. 13B

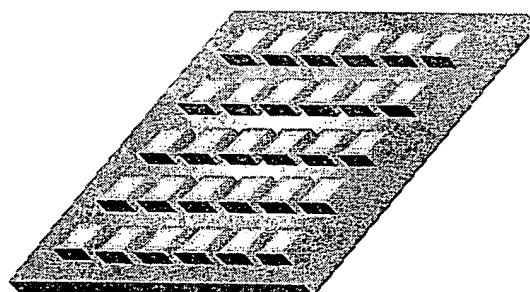


FIG. 13C

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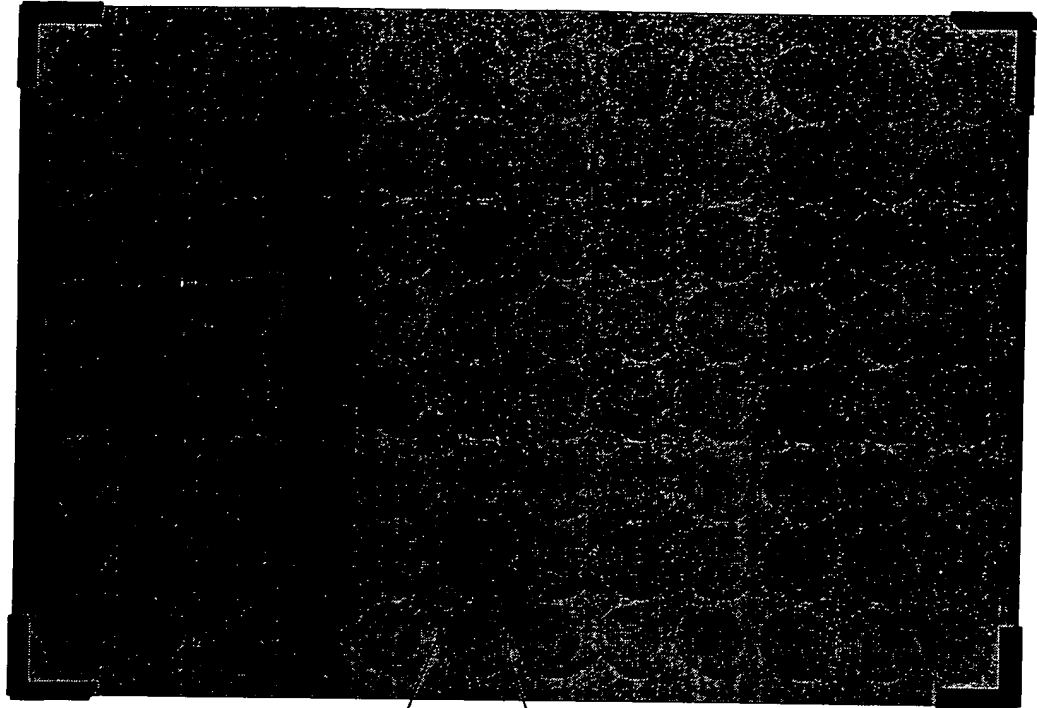


FIG. 14A

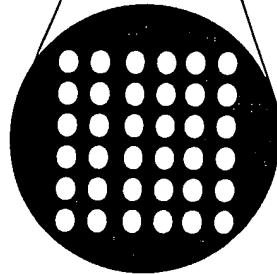


FIG. 14B Elevated sub-structure



FIG. 14C Planar sub-structure

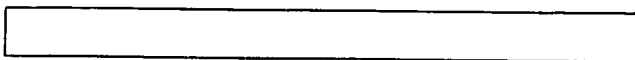
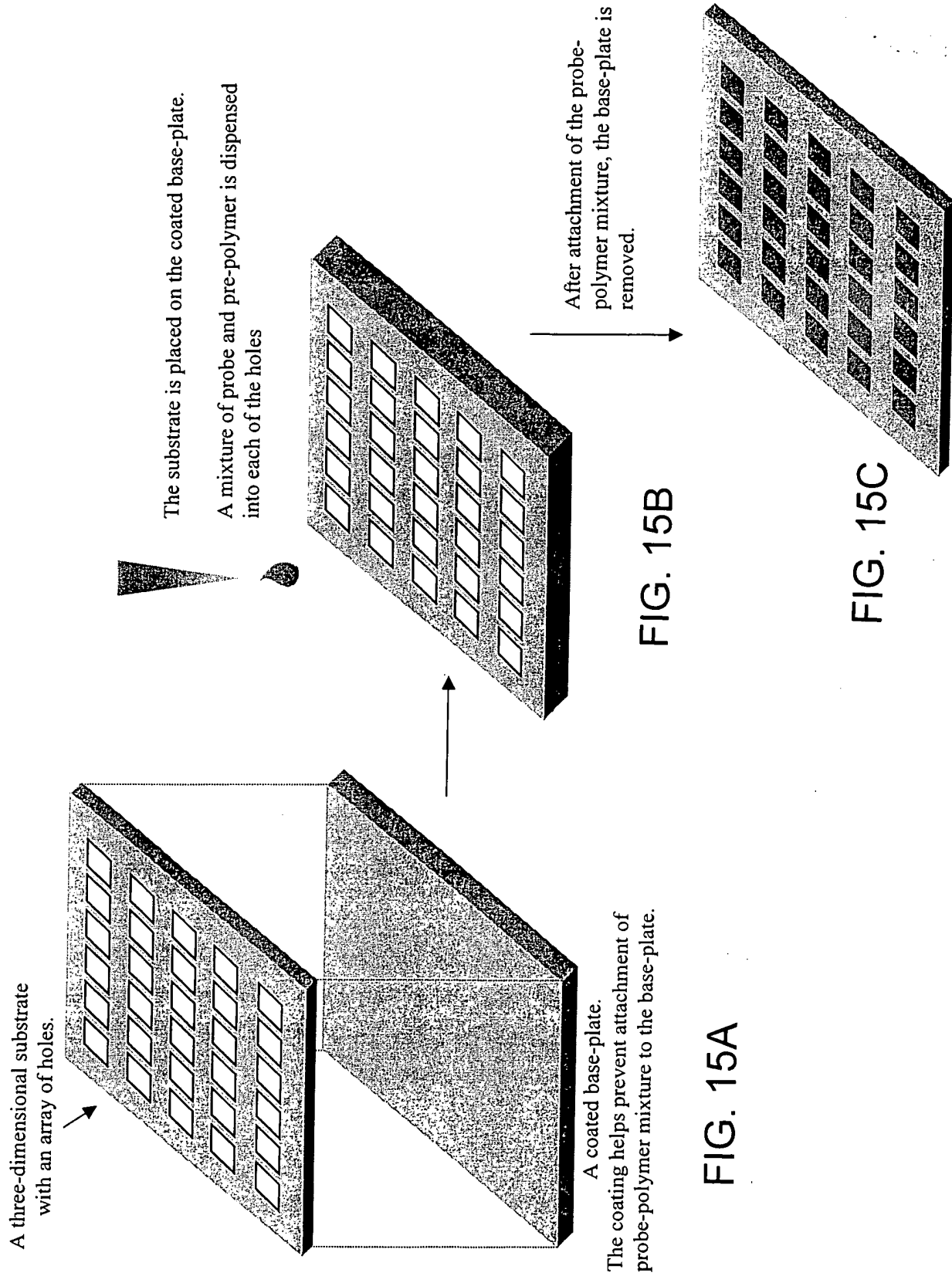


FIG. 14D Depressed sub-structure





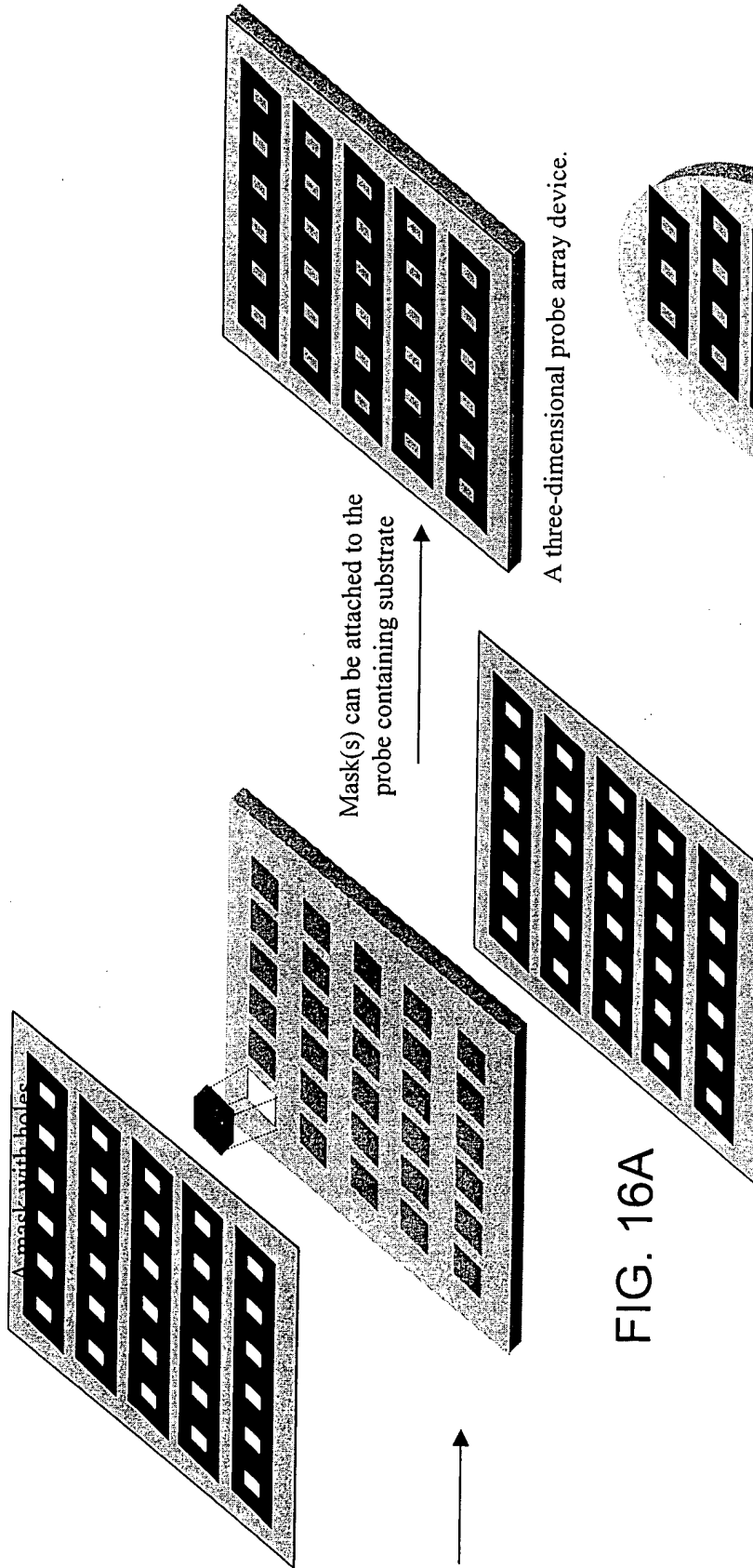


FIG. 16A

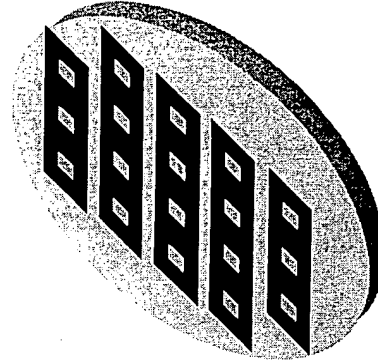


FIG. 16B

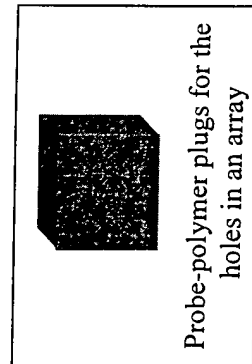


FIG. 16C

The microarray biochip can
Also be housed in a sealed chamber.

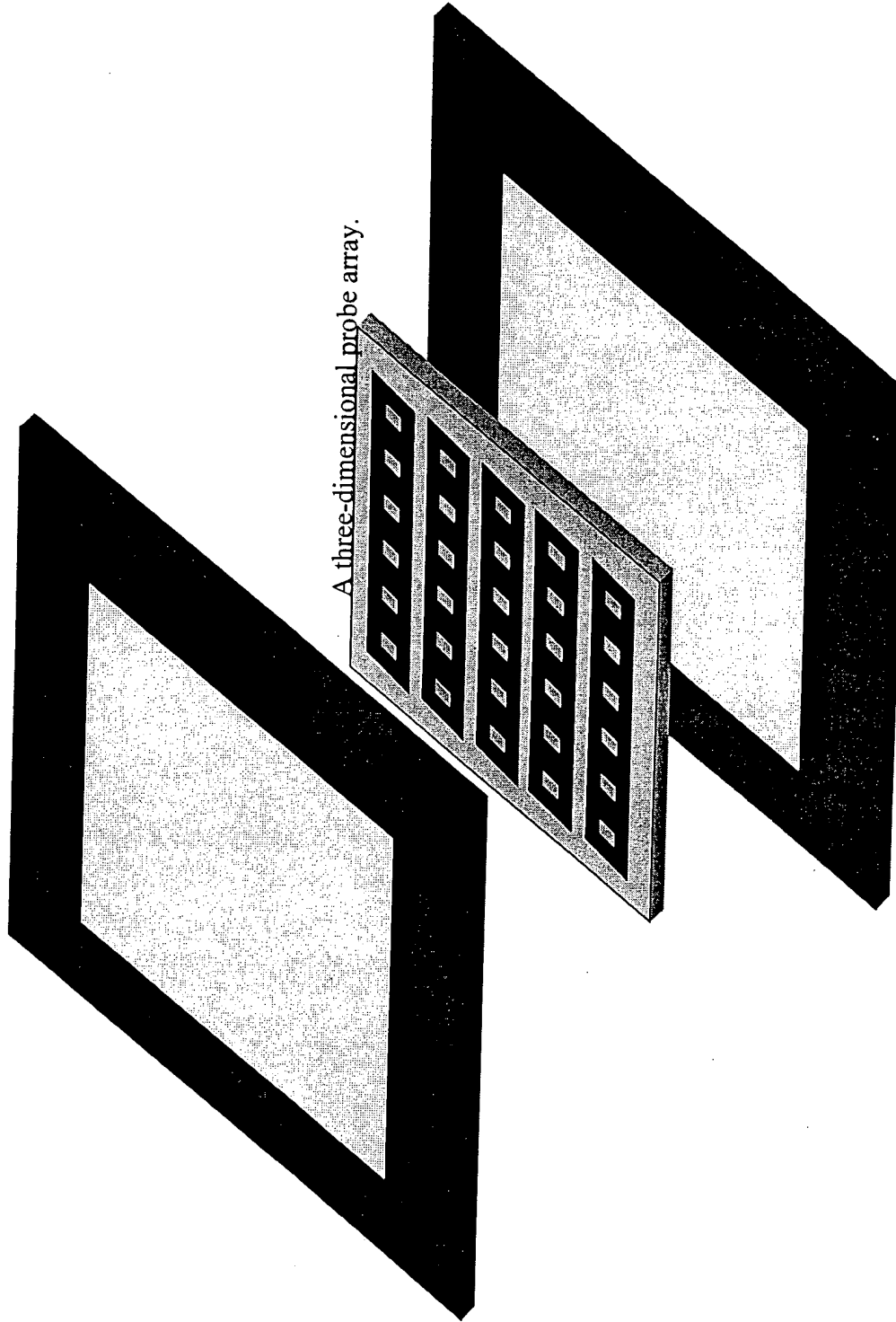
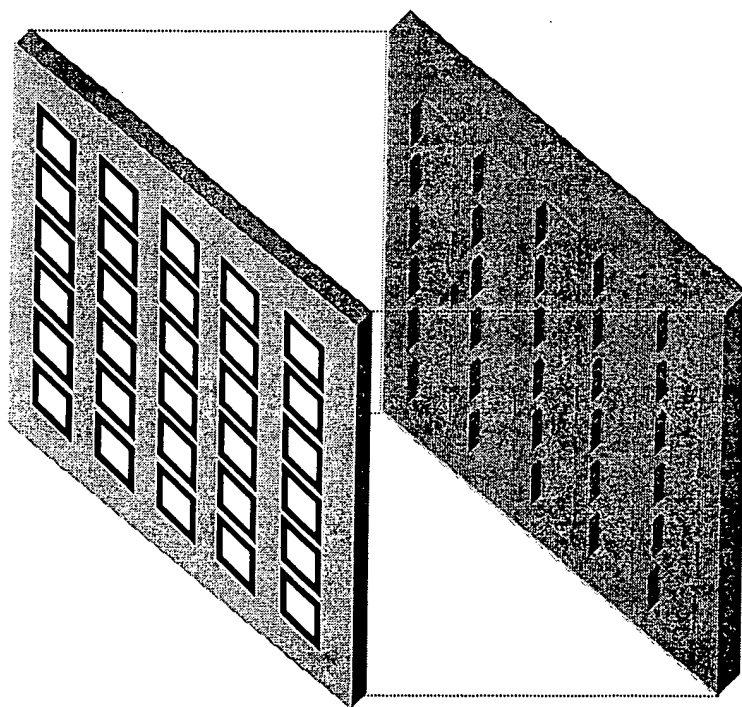


FIG. 17



A coated base-plate with depressions or chambers to hold fluids.
 The coating helps prevent attachment of probe-polymer mixture to the base-plate.

FIG. 18A

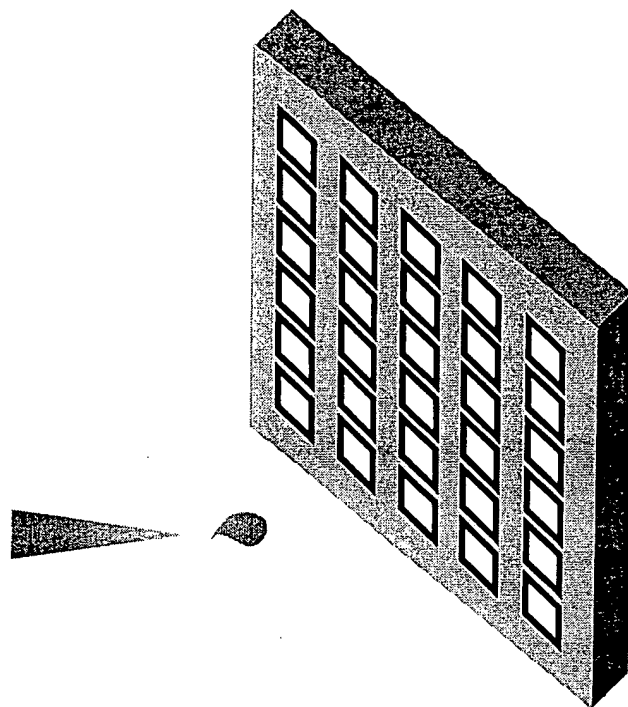


FIG. 18B

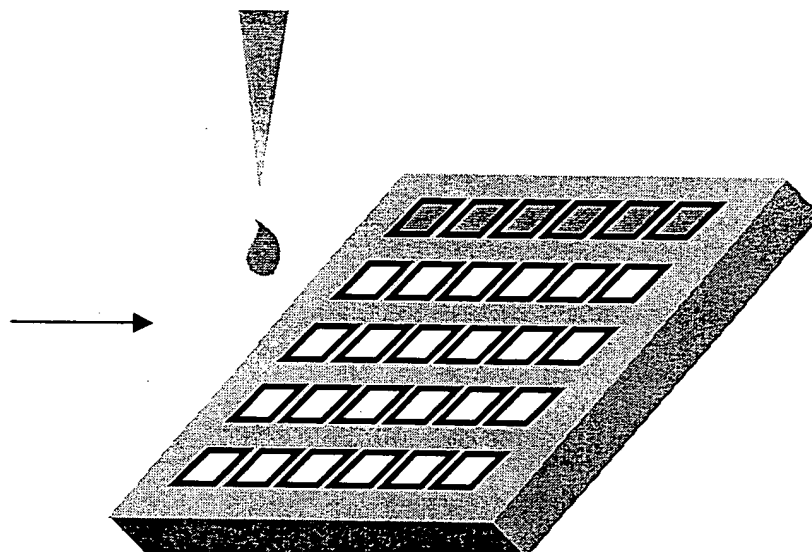
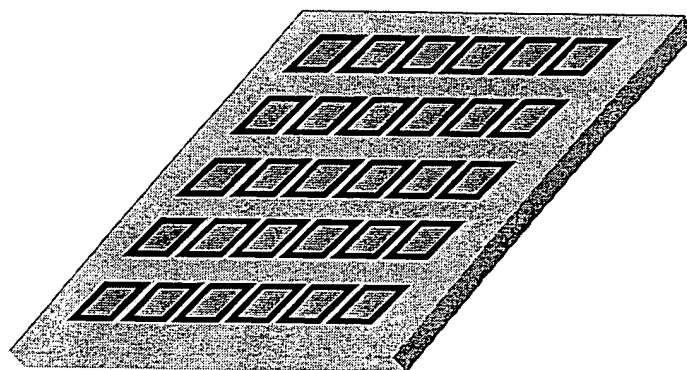


FIG. 19A



Another implementation of 3D porous biochip

FIG. 19B

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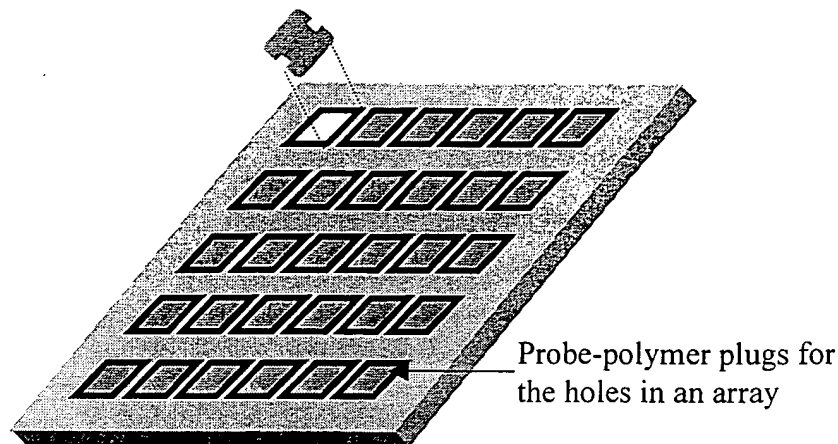


FIG. 19C

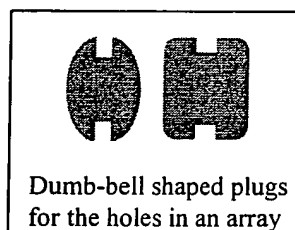
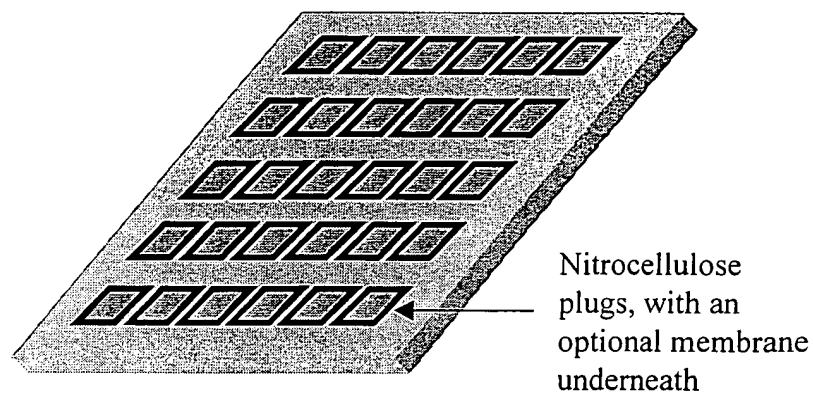


FIG. 19D



Two examples of the types of material that can be used to manufacture the 3D porous array

FIG. 19E

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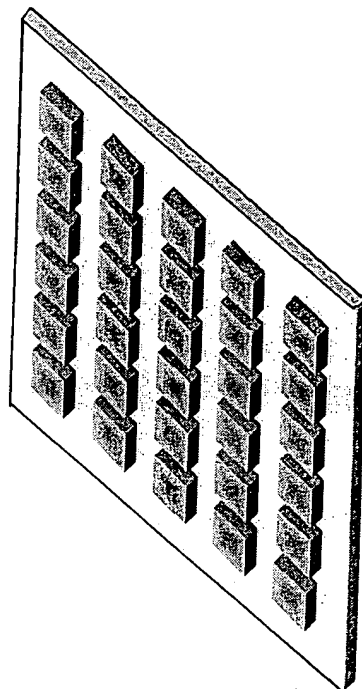
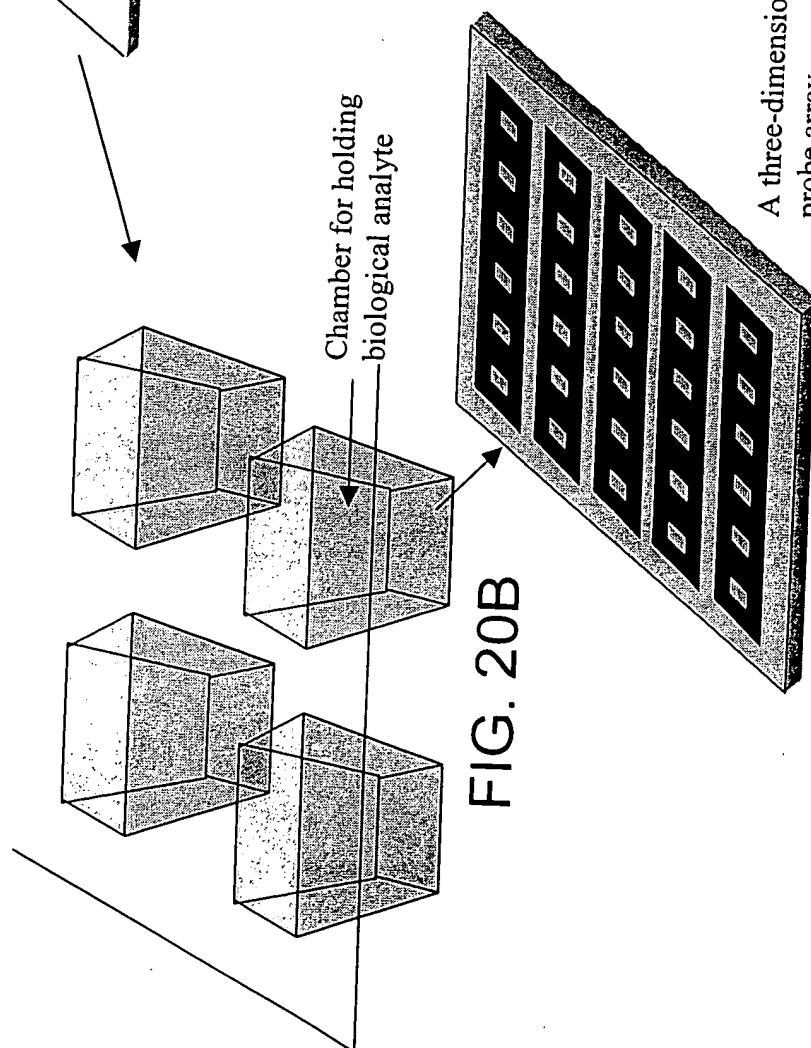


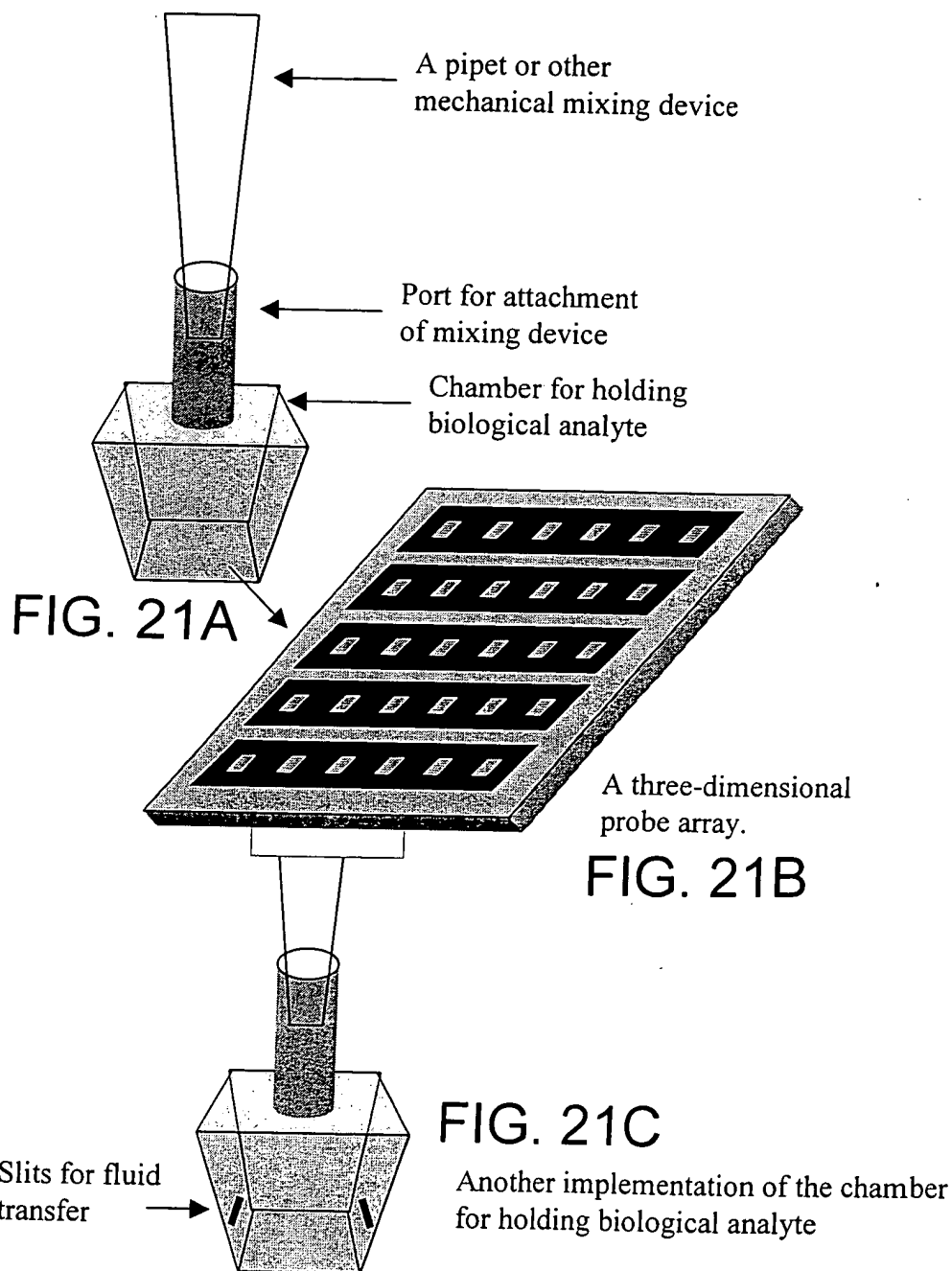
FIG. 20A

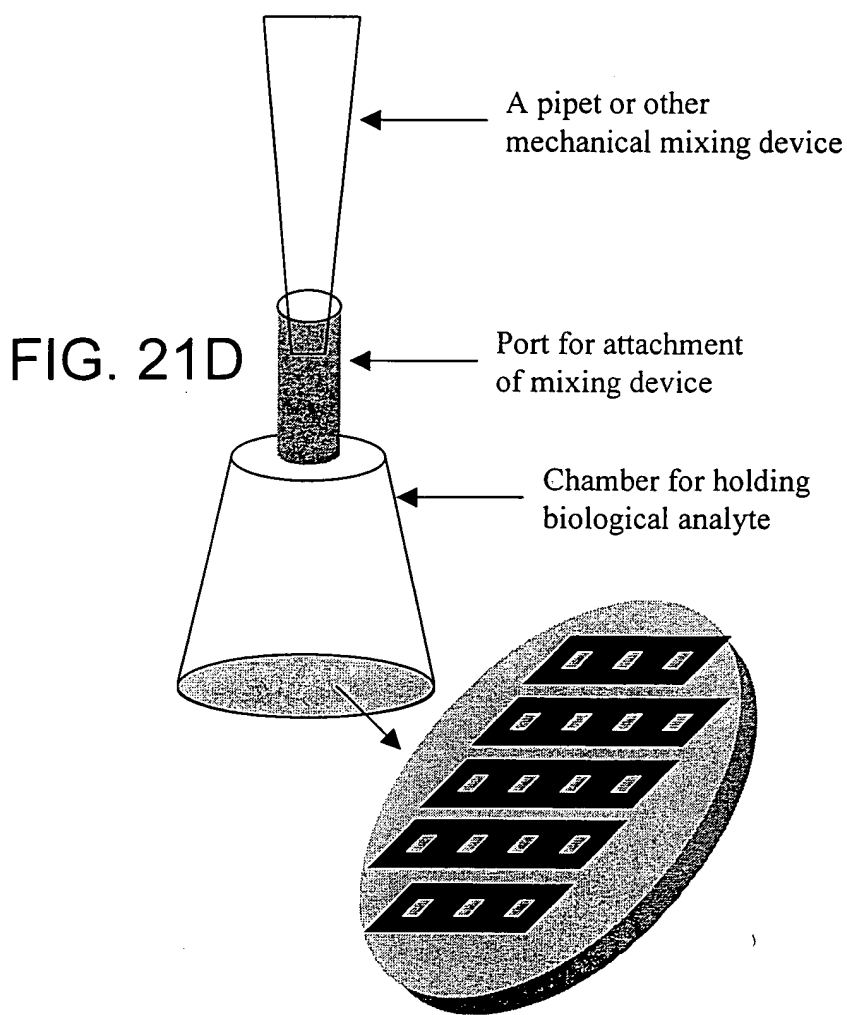


A three-dimensional
probe array.

FIG. 20C

The microarray biochip can also be housed in a sealed hand-held or Point of Care device.





A three-dimensional probe array.

FIG. 21E

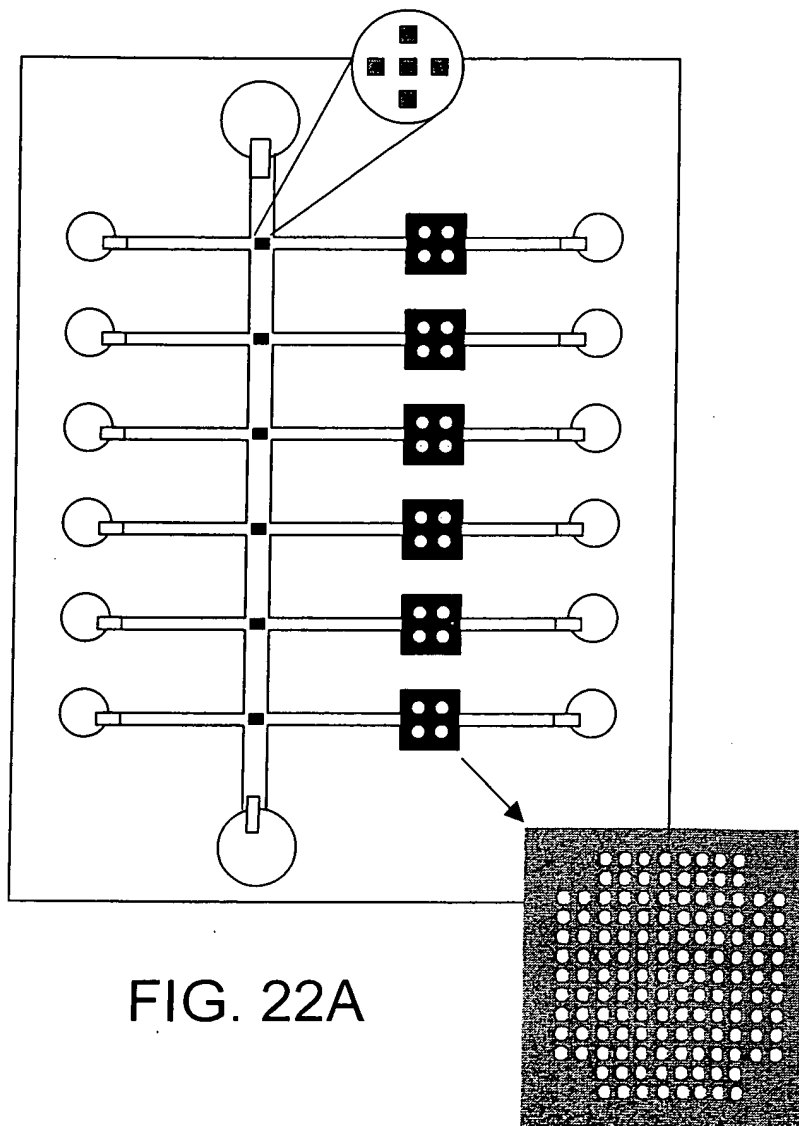
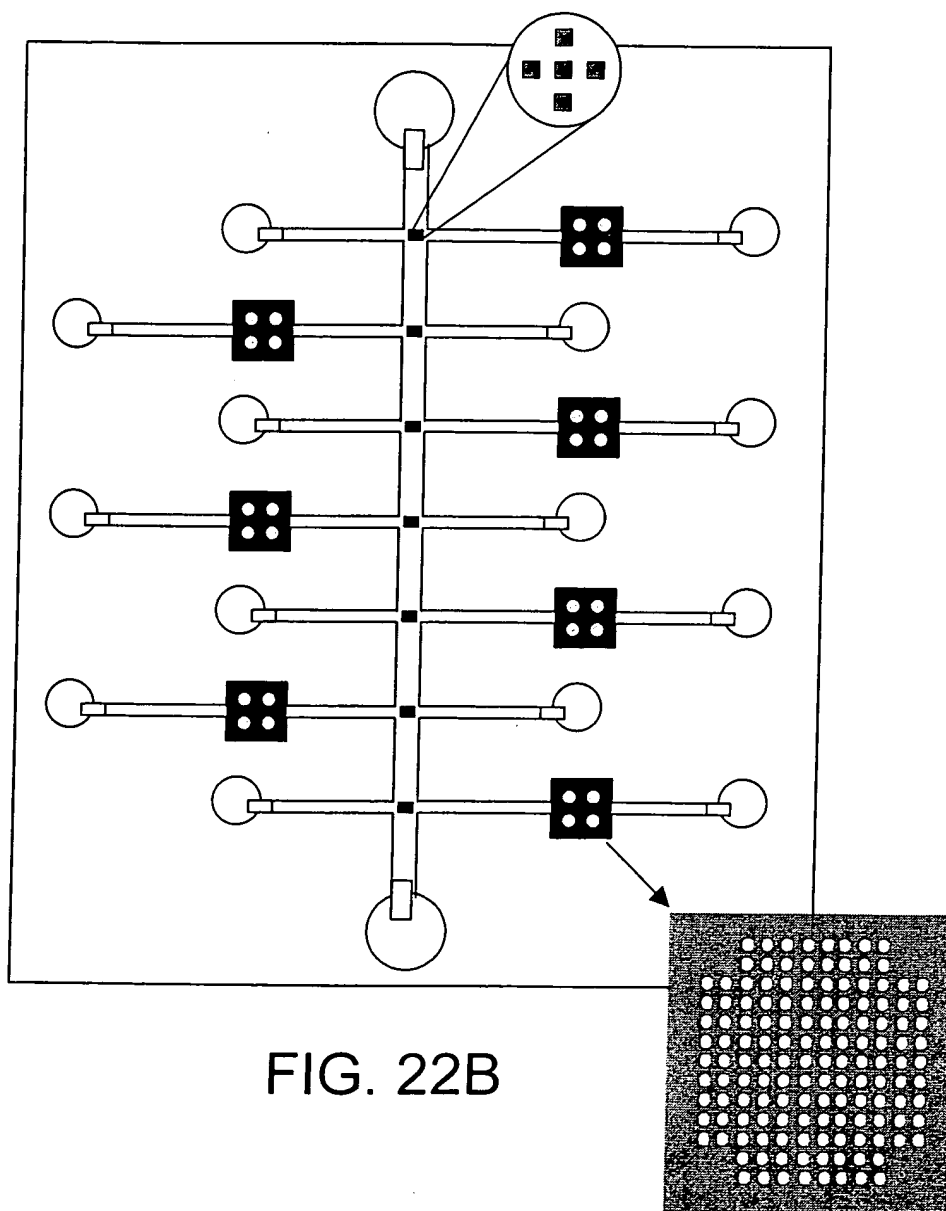


FIG. 22A



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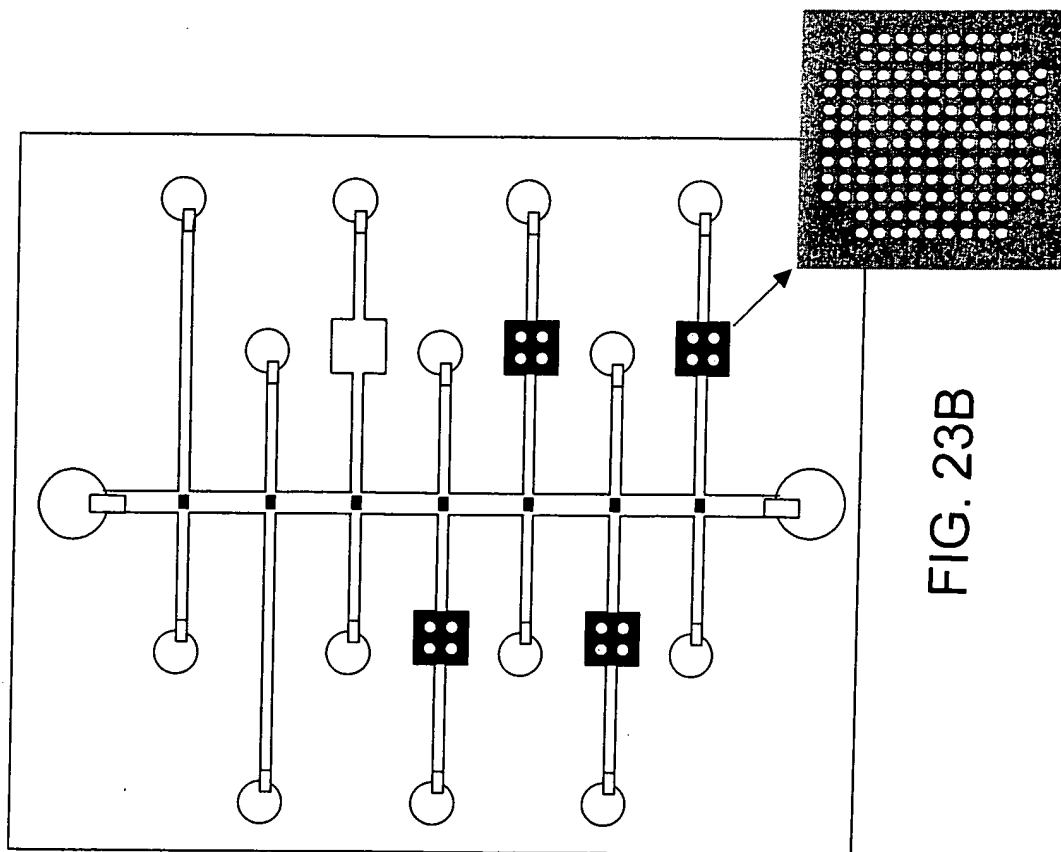


FIG. 23B

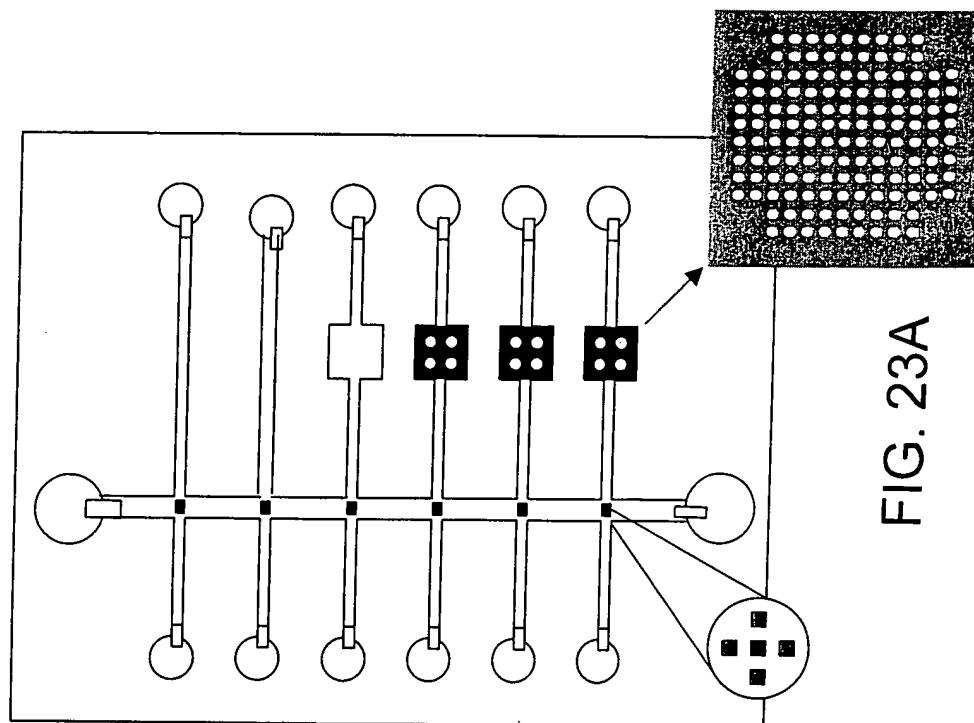
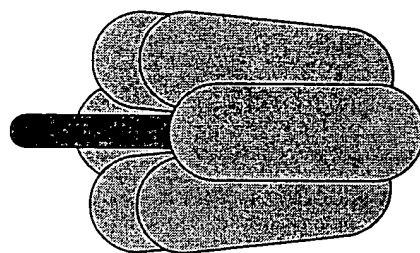


FIG. 23A

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ATPase based Fluid-Micromixers



Cartoon of the multi-subunit enzyme – ATPase – that rotates in response to ATP synthesis to hydrolysis. The centrally located γ -subunit rotates relative to the hexameric α,β -subunit core.

FIG. 24A

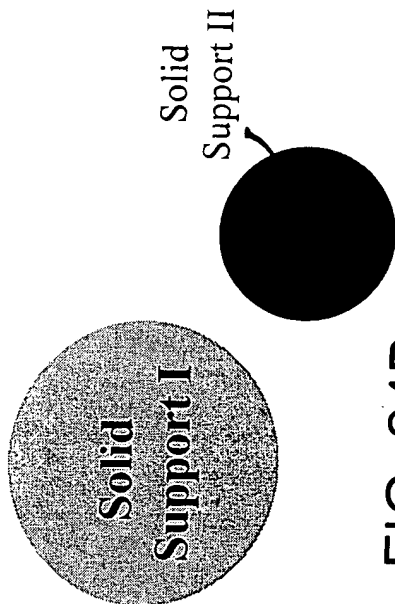
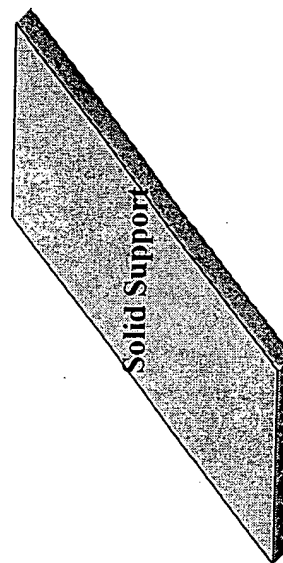


FIG. 24B

Spherical Beads as Solid supports for attaching different subunits of ATPase

Linkers for attaching different subunits of ATPase to the solid support

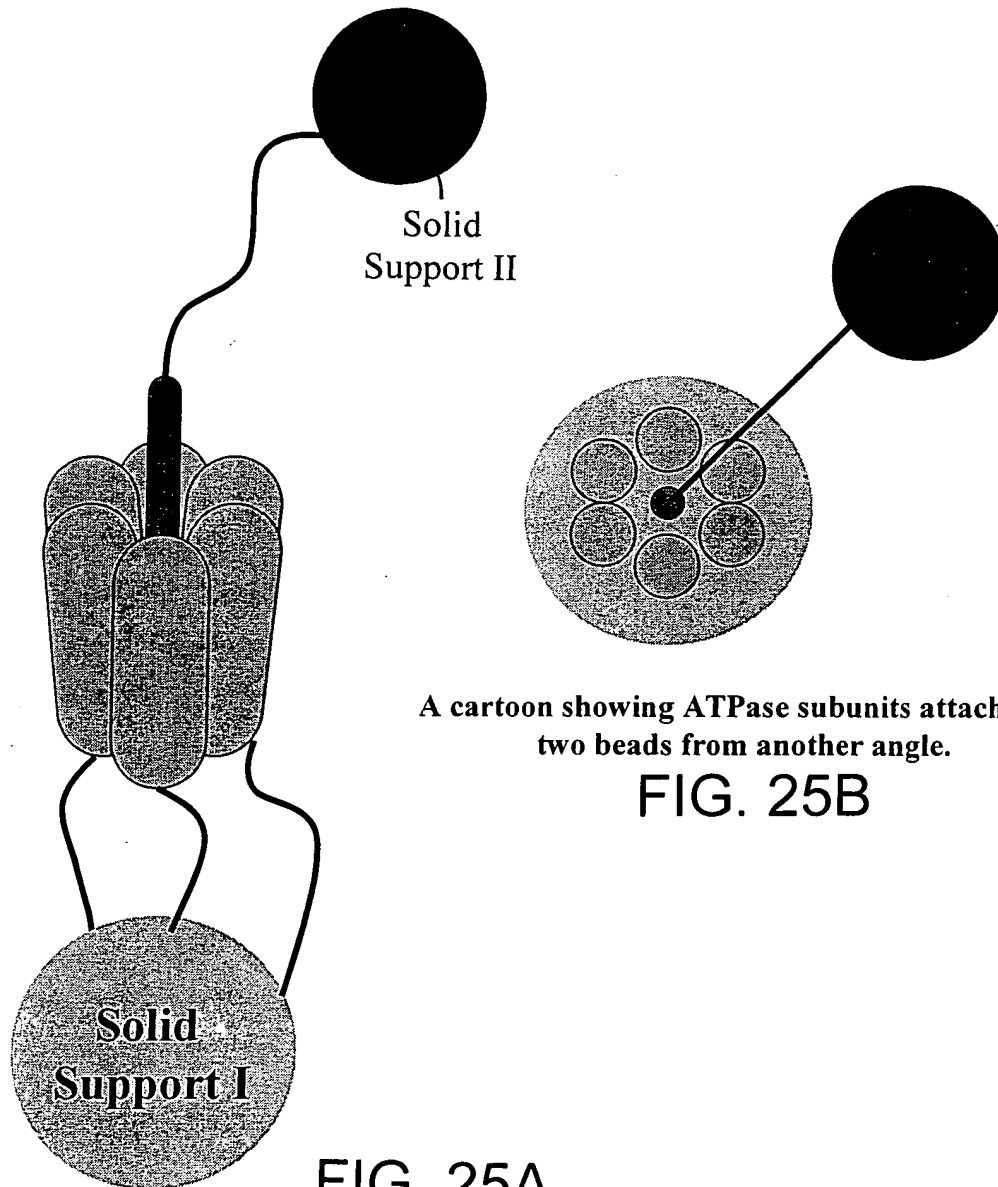
FIG. 24C



Flat platform base as Solid supports for attaching one of the subunits of ATPase

FIG. 24D

ATPase based Fluid-Micromixers, Model I

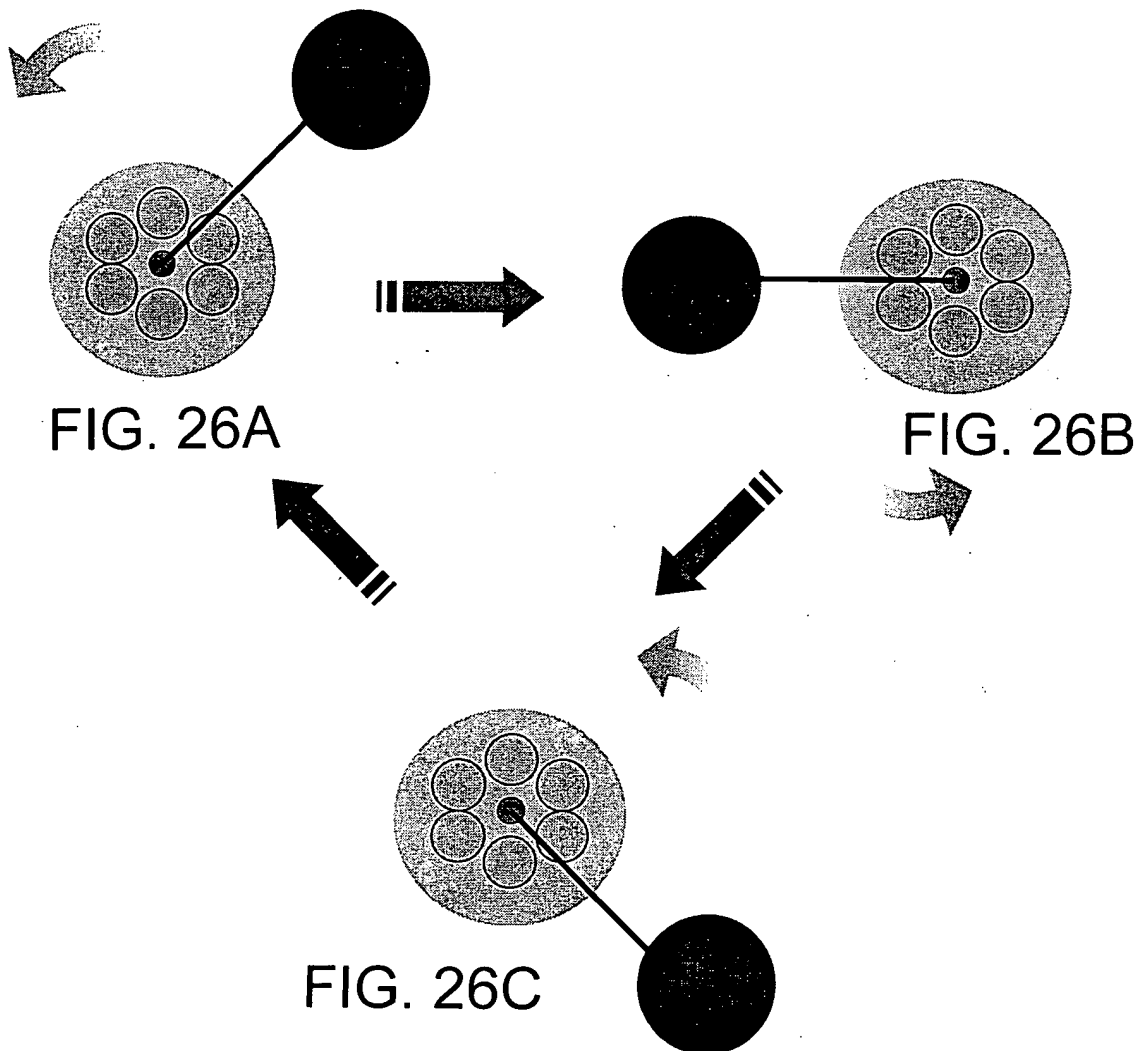


A cartoon showing ATPase subunits attached to two beads from another angle.

FIG. 25B

One particular implementation of ATPase-based fluid-micromixers. The γ -subunit and the α,β -subunit core are both attached to two different spherical beads.

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A cartoon showing multiple Model I Micromixers in action in a solution

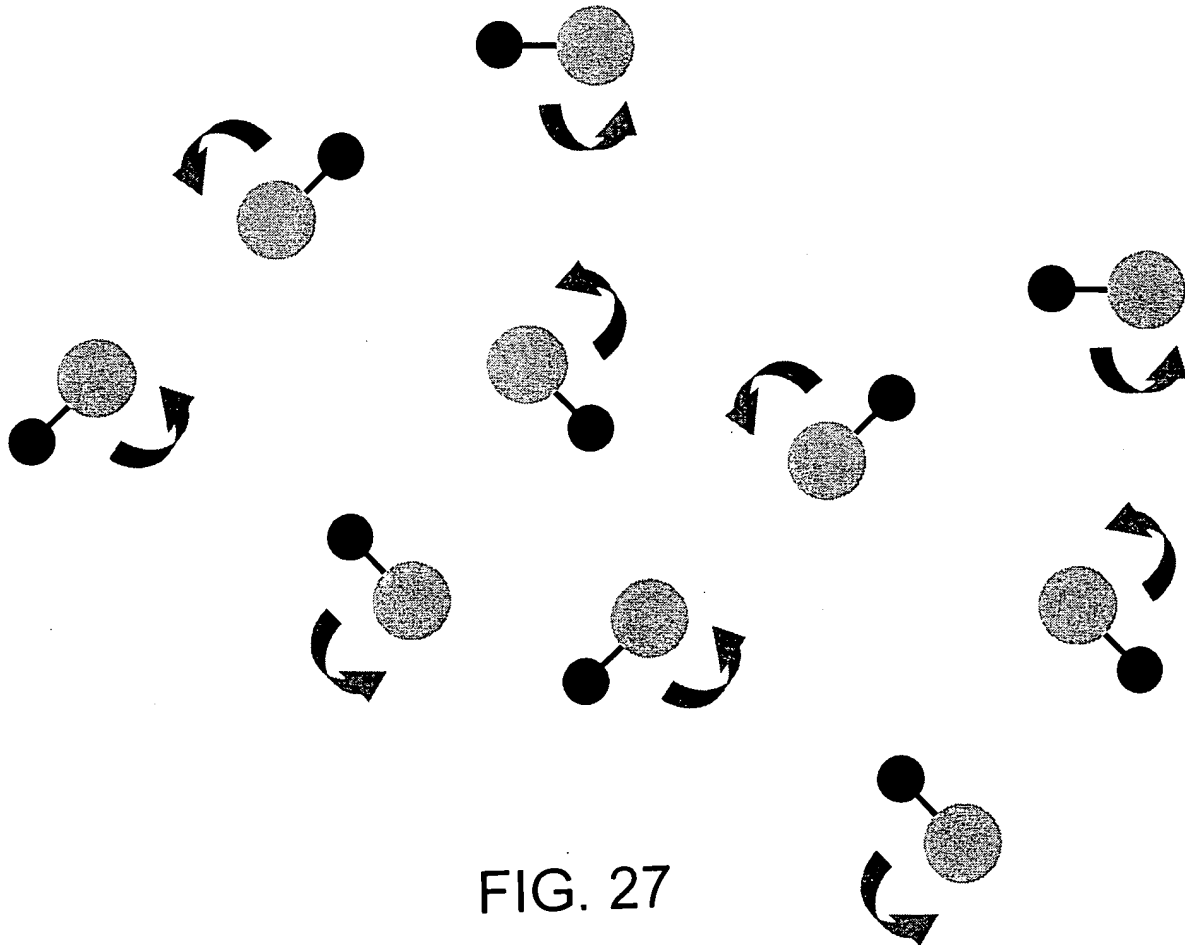
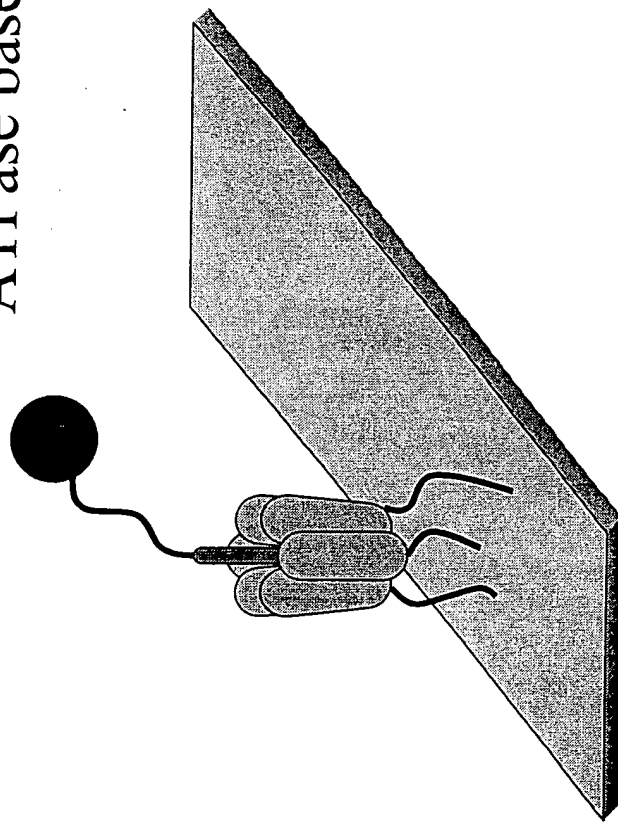


FIG. 27

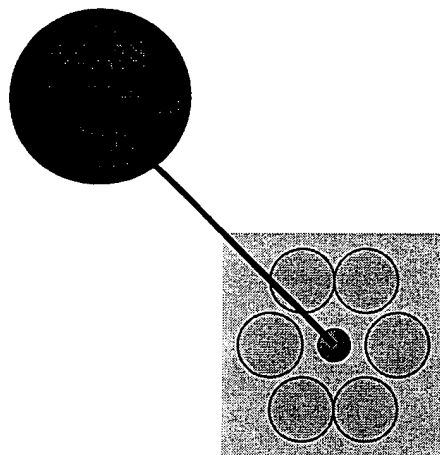
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ATPase based Fluid-Micromixers, Model II



Another implementation of ATPase-based fluid-micromixers. The γ -subunit is attached to a spherical bead and the α, β -subunit core is attached to a solid platform.

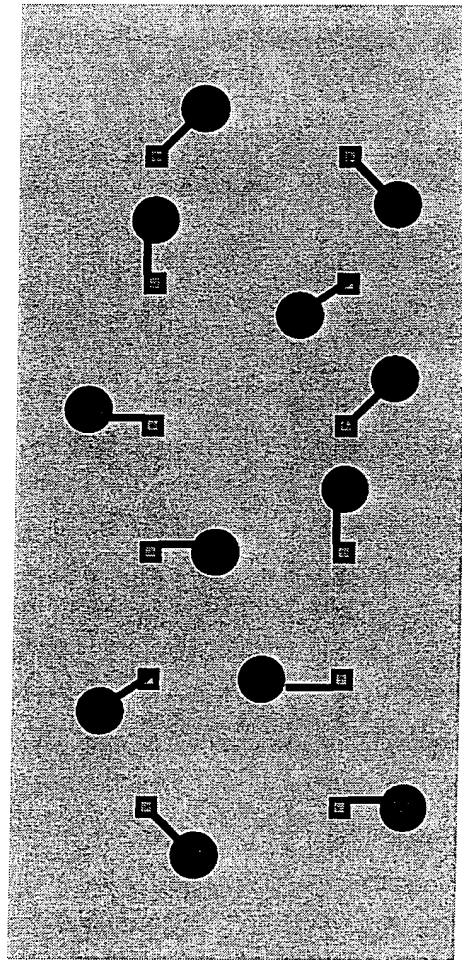
FIG. 28A



A cartoon showing ATPase subunits attached to two different surfaces from another angle.

FIG. 28B

A cartoon showing multiple Model II Micromixers in action in a solution



All the mixers are moving in a counter-clockwise direction

FIG. 29

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Kinesin and Myosin based Fluid-Micromixers

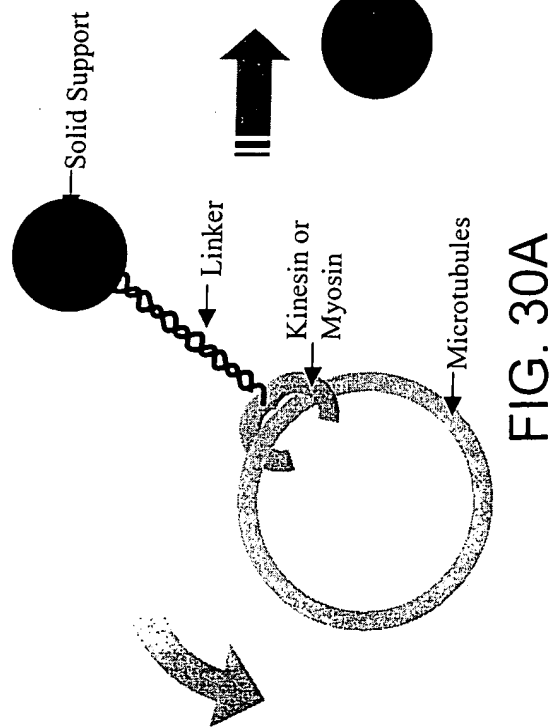


FIG. 30B

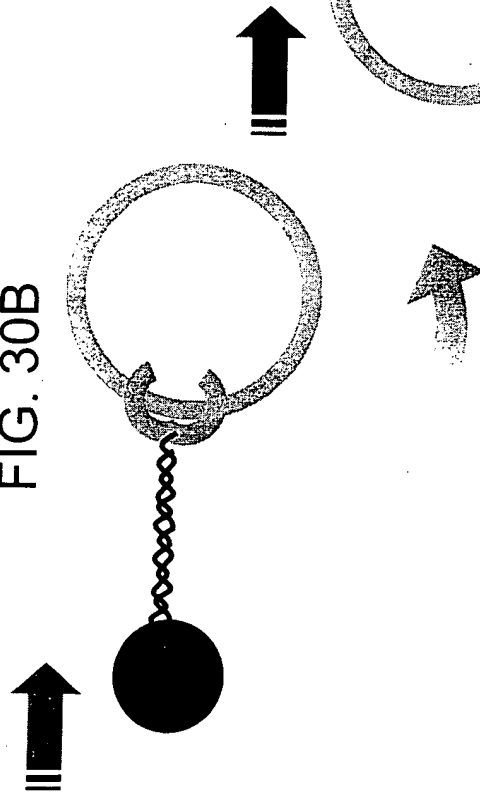


FIG. 30A

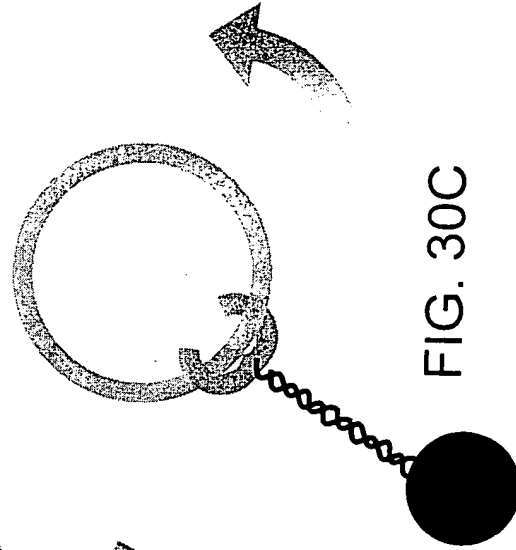


FIG. 30C

Circular Triplex Forming Oligo (CTFO) DNA and Other Pseudo-rotaxane based Fluid-Micromixers

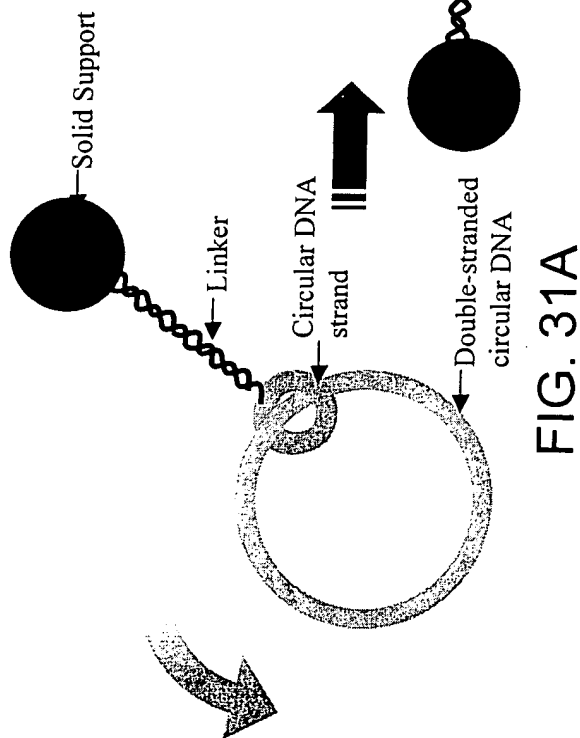
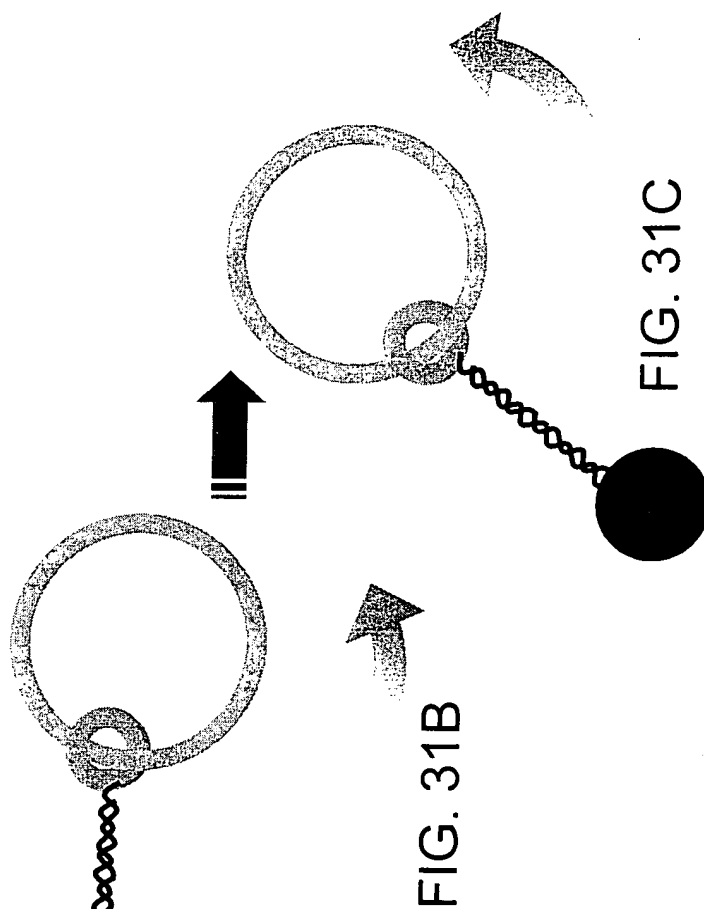
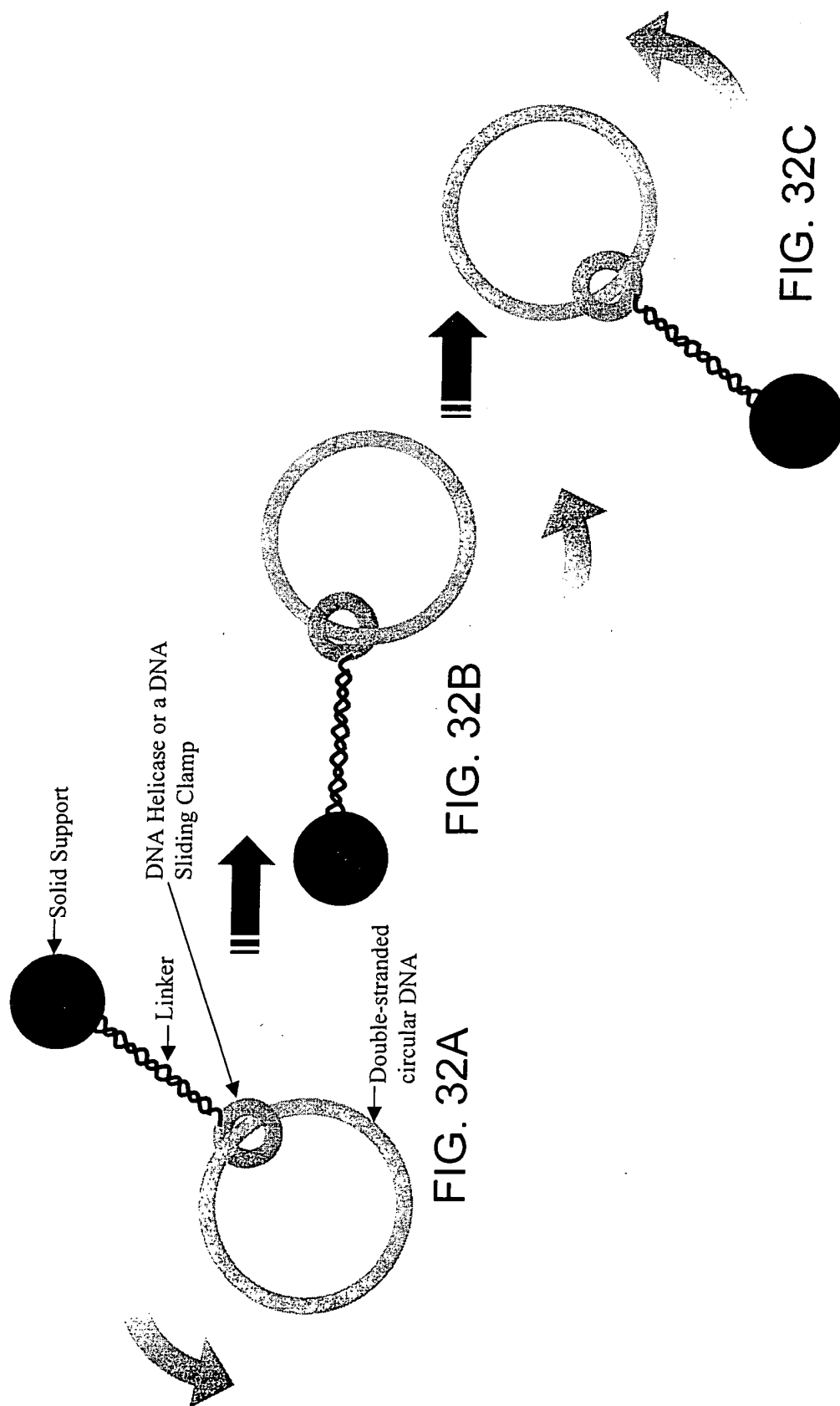


FIG. 31A



DNA Helicase and DNA Sliding Clamp based Fluid-Micromixers



DNA Helicase (bound to Circular Triplex Forming Oligo (CTFO) or a Sliding Clamp) based Fluid-Micromixers

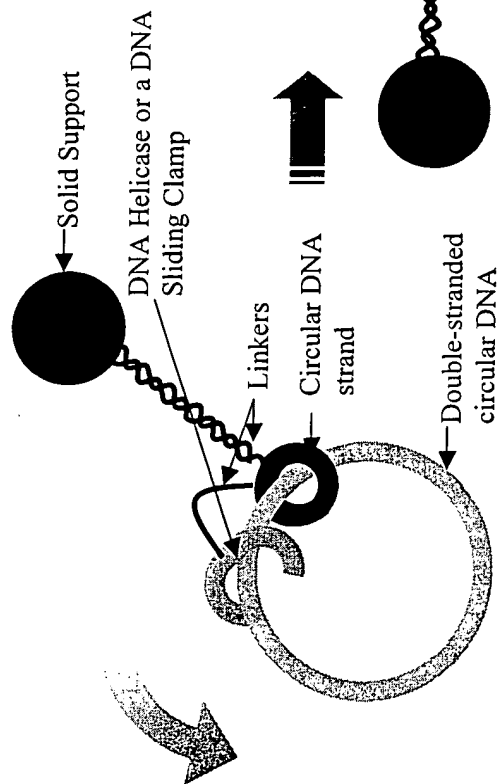


FIG. 33A

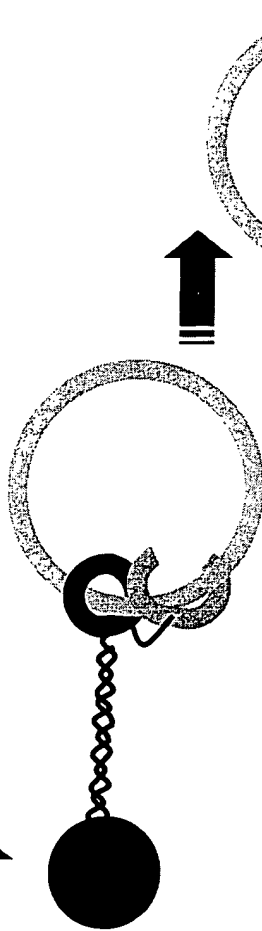


FIG. 33B

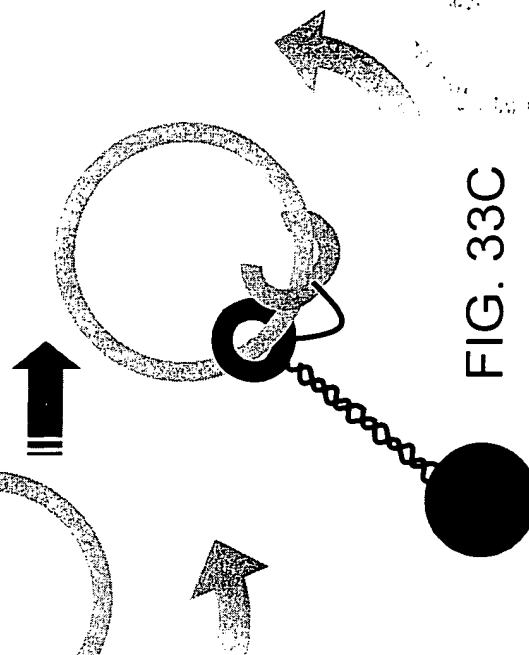
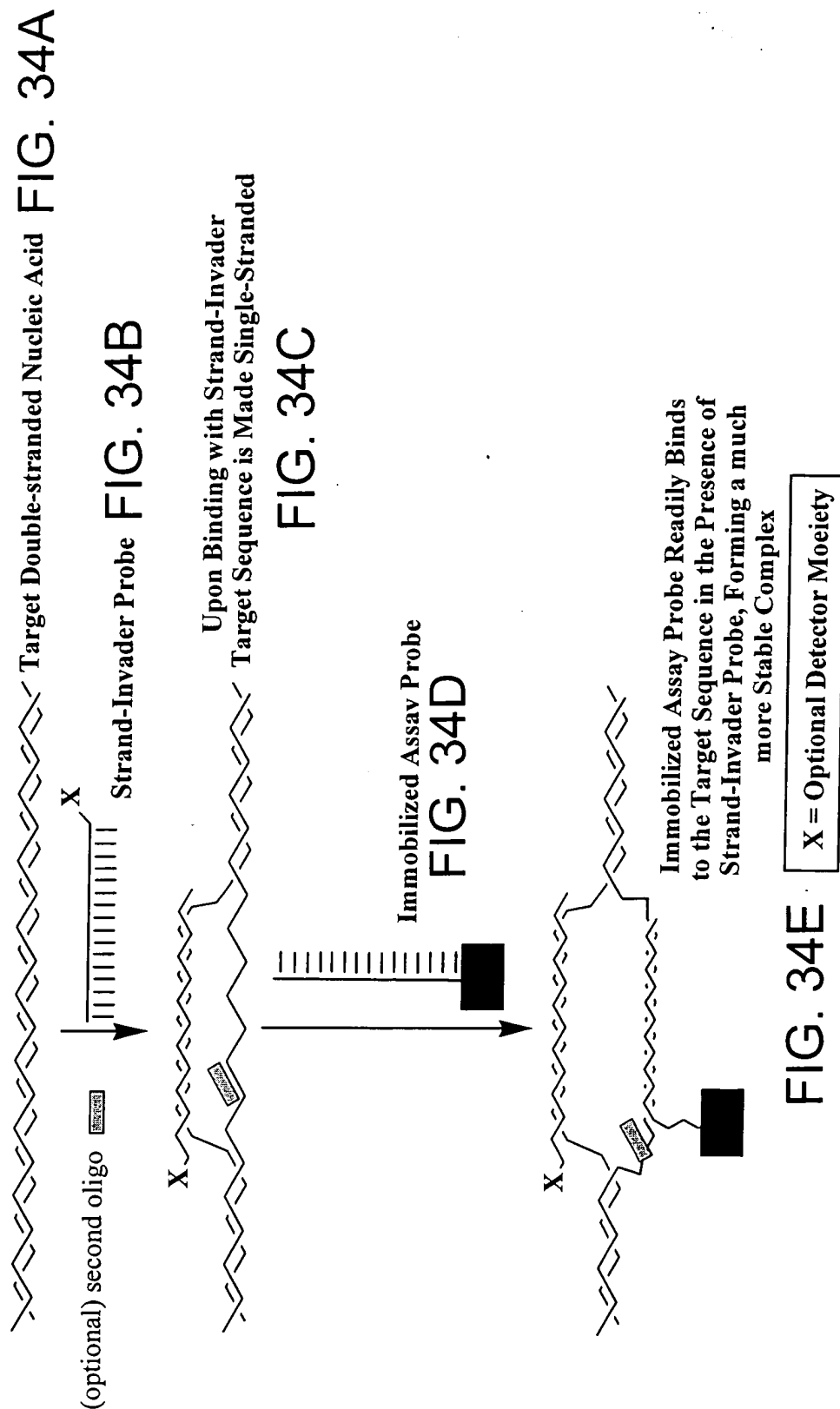


FIG. 33C

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Hybridization Enhancement Using Strand-Invader Molecules



A gasket/separator can be used in the current hybridization chambers to place two biochips facing each other in a single chamber for duplicate experiments.

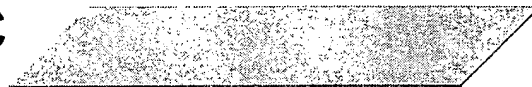


FIG. 35A

FIG. 35B



FIG. 35C



Biochip

FIG. 35D



Separator

FIG. 35E



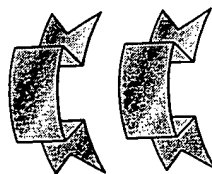
Biochip

FIG. 35F



Holder

A sketch of one example of a new hybridization chamber.
A hybridization chamber can be devised such that it fits
two biochips.



Hybridization Chamber
Clamps

FIG. 35G

- I A gasket/separator can be used in the current hybridization chambers to place two biochips facing each other in a single chamber for duplicate experiments.

Hybridization Chamber
Clamps

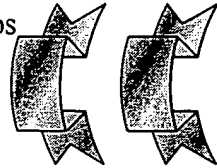


FIG. 36A

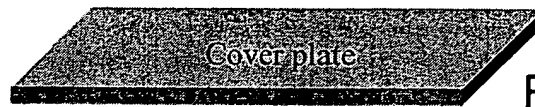
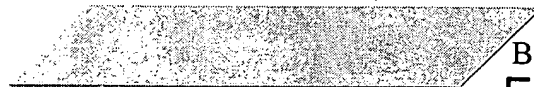


FIG. 36B



Biochip
FIG. 36C

Slot for introducing
biological sample after
assembly

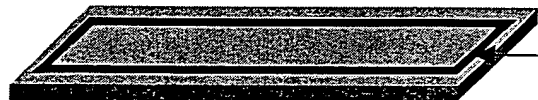


Separator

FIG. 36D



FIG. 36E



Holder

FIG. 36F

- II The separator can also be built into the chamber.



FIG. 36G

Cross-section view

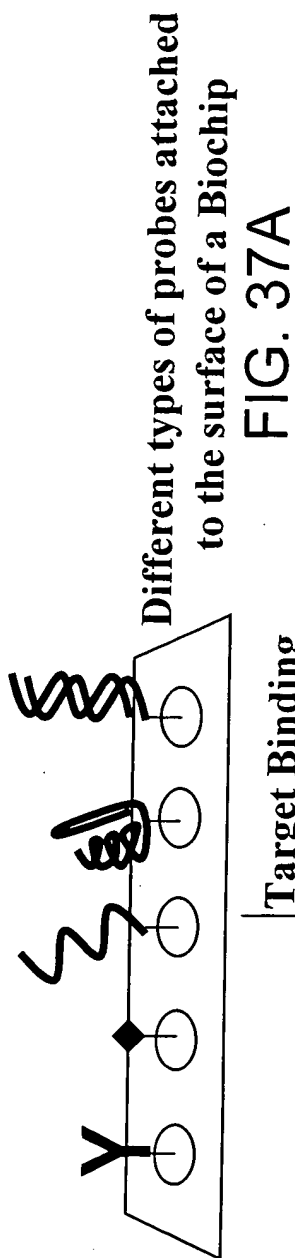
Slot for introducing
biological sample



Biochip, placed into one of the
grooves of a hybridization chamber

FIG. 36H

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Target Binding

